River Road Environmental Technology Centre

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Annual activity report
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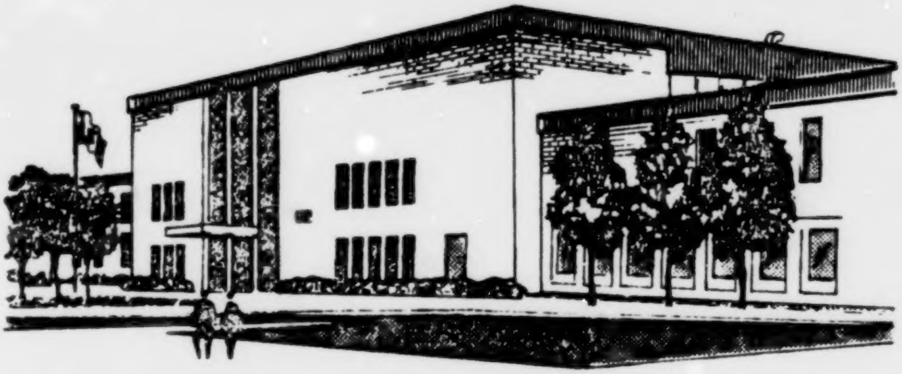

Annual Activity Report

April 1, 1990 to March 31, 1991

Environment Canada
Conservation and Protection
Technology Development Branch

River Road Environmental Technology Centre

Annual Activity Report
April 1990 - March 1991

Conservation & Protection
Technology Development Branch
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Report 91-11

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Introduction

The River Road Environmental Technology Centre (RRETC) is located in Gloucester, Ontario, close to the Ottawa International Airport. The RRETC is operated by Conservation and Protection, Environment Canada, in support of the federal mission to protect the environment. RRETC deals primarily with technologies to measure air pollutants and to respond to spills of hazardous materials. A significant proportion of the technology work is contracted to the private sector.

The activities of the RRETC are summarized on a yearly basis in the Annual Activity Report series. Project results are documented in informal (unedited) reports, and a formal Environment Canada (edited) report series available in both official languages. In addition, staff contribute technical papers to journals and to proceedings of conferences and workshops. A summary of reports and papers from the Centre in 1990/91 is included in *Appendix A.*

Also, a listing of staff members is included in *Appendix B.*

ACKNOWLEDGEMENT

Janet Fewster co-ordinated the preparation of this Annual Activity report.

Director's Office (DO)

The DO is responsible for the provision of general direction to the RRETC programs and for provision of central services such as administrative support and computing assistance. In addition, co-ordination of special issues is undertaken on occasion.

DO Highlights

1. Three generic acute lethality testing methodologies, two effluent-specific Reference Methods for the Pulp-&-Paper Regulations, and a guidance document on Reference Toxicants were published as DOE Aquatic Biological Test Methods.
2. A pilot electronic reporting format and recipient database was developed for compliance reporting of toxicity information required by the proposed pulp and paper effluent regulations.
3. An environmental audit was completed for the Centre and an Action Plan in response was developed and implemented.
4. The completion of eleven discussion papers on marine spill preparedness and response was coordinated as part of an Interdepartmental Review on Marine Spills. The papers and briefings on their contents were provided to the Public Review Panel on Tanker Safety and Marine Spills Response Capability, and a draft chapter on Research & Technology Development the Panel's stat report was prepared.

Chemistry Division (CD)

The Division has a capability to analyze for a variety of organic and inorganic compounds in diverse sample matrices which usually originate from air pollution-related sources. Analytical method development work is also undertaken to ensure the most appropriate procedures are used for specific sample types and to support the development of environmental regulations.

The Organic Laboratory measures ultra trace (ppt, ppq) levels of many organic compounds with particular emphasis on the analysis of chlorinated dibenzo-p-dioxins (PCDD), chlorinated dibenzofurans (PCDF), polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons (PAH) and priority pollutants. A specially designed and operated Organic Trace laboratory is used for the analysis of these toxic pollutants. The laboratory carries out major analytical projects in support of national programs; develops analytical Reference Methods to support CEPA regulations; designs and implements interlaboratory studies to validate *procedures; and manages QA/QC and method development programs to ensure data generated by contract labs for ultra-trace levels (ppt, ppq) of these organic compounds in complex sample matrices are of the highest quality.*

The Inorganic Laboratory develops ultra-trace methods (detection limit 0.1 ppt) for the determination of elements and anions in air particulates and applies the developed methods in the analysis of air particulates. Major techniques used are X-ray fluorescence and ion chromatography. Ion chromatography is used for the analysis of ten major anions including the "acid rain" components, that is sulphate and nitrate. X-ray fluorescence is used for the analysis of forty elements (aluminum up to lanthanum and lead). The laboratory participates in different round-robins at the national or international level. The laboratory performs legal analysis of samples for regions and for CEPA, and provides advice on analytical equipment and methods to private industry and governmental laboratories.

A Quality Assurance/Quality Control (QA/QC) Section undertakes QA/QC activities in support of activities of the Federal-Provincial Advisory Committee on Air Quality (FPACAQ).

CD Highlights

1. **The 4th draft of the Reference Method for the determination of PCDD/F in pulp and paper mill effluents was prepared. In order to determine the Level of Quantification (LOQ) and validate the Reference Method for CEPA regulation, 700 1-L effluent samples from four selected pulp mills have been collected and an interlab study is being planned to invite potential participating labs from both government and private sectors.**

2. **Chemistry Division chaired a joint federal/industry analytical working group to identify the needs and prepare workplans to update the analytical Reference Method for the CEPA regulation controlling vinyl chloride emissions.**

3. **Various cleanup methods for analyzing PCB in transformer oil using GC/MSD and several chromatographic methods for the fractionation of nitro-PAH were evaluated and reports prepared.**

4. **At the request of the Dioxin QA Advisory Committee, a 4th draft of the Dioxin Quality Assurance Protocol was prepared. This document has been distributed to commercial laboratories and members of the C&P Lab Manager's Committee for review and comment.**

5. **In support of various government programs such as: the BC Kraft Boiler Emission Study, the Goose Bay PCB Waste Incineration Project and the Quebec Ambient Air Monitoring, analytical procedures, QA/QC protocols and QA samples were provided to contract labs. Chemistry Division also monitored the performances of the contract labs and analyzed QA samples for semi-volatile organics.**

6. Dioxin calibration standards and spiking solutions were prepared and provided to participating labs for the 2nd Ambient Air Dioxin round robin study organized jointly by Ontario MOE and RRETC. A total of 20 leading labs from the US and Canada participated in the study.

7. A number of draft reports on the FPACAQ QA program have been prepared and reviewed. Final reports are being prepared.

8. CD participated in round-robin studies initiated by Alberta Research Council for the analysis of lead and manganese in gasoline.

9. In support of the Ontario Region ambient air monitoring program for the Great Detroit Resource Recovery Authority incinerator, a total of 258 ambient air samples from Windsor and Walpole sites were analysed for SVOC.

Emergencies Science Division (ESD)

The ESD undertakes research on the properties, behaviour, and effects of spilled hazardous materials and on the effectiveness and environmental benefits of in situ countermeasures such as spill-treating agents, burning, and bioremediation. Such infomation is used to develop research and operational models which predict the behaviour and fate of untreated and treated spills.

R&D is also performed on techniques for measuring contamination in air, water, and soil at spill sites and on technologies for airborne remote sensing of spills.

The Division also generates technical spill-response guidelines and manuals for use by responders and contingency planners, and serves as the primary centre of scientific advice on pollution emergencies to the regions and others. For spills of national concern, this role includes direct involvement in response operations through the provision of airborne remote sensing services or on-site specialized sampling and analytical support. Further, training in the use of personal protection equipment and portable hazard-level monitoring equipment is provided to departmental emergencies personnel and to other responders.

The Division coordinates the preparation of the quarterly Spill Technology Newsletter and the delivery of the annual Arctic & Marine Oilspill Program (AMOP) Seminar and Technical Seminar on Chemical Spills (TSCS).

ESD Highlights

1. In response to a request for assistance from EP Quebec, on-site hazard-level monitoring assistance was provided at the St Amable and Ste. Anne-des-Plaines Tire Fires.

2. The 13th AMOP annual seminar was convened in Edmonton on June 6-8 and the 7th TSOCS annual seminar on June 4-5.

3. G. Sergy was part of the Canadian Assessment Team sent to assess the preparedness of Qatar and Bahrain. A shoreline mapping and cleanup-planning project was initiated and managed for both countries

4. Dr. J. Paré was awarded a patent for a μ-wave-assisted extraction process and discussions were held to licence this technology to clients in Canada, France, U.S.A. and Japan.

5. M. Fingas advised the US National Oceanic and Atmospheric Administration (NOAA) on the properties and behaviour of Kuwait crude oil following the spill in the Persion Gulf.

6. M. Fingas was invited to Washington on three occasions to participate in the U.S. National Academy of Sciences review of oil spill preparedness, and to review oil-spill Biodegradation for an assembly of U.S. government and industry senior officials.

7. Special information, assistance and modelling input was provided on the following spills:

    - August 23 - Hydrofluorosilicic acid spill, Edmonton;
    - August 15-20 - Spill of water treating chemicals in Vancouver;
    - August 8, 9 - pesticide fire , Harrow, Ontario;
    - August 29 - Oil identification problem - Montreal;
    - September 10 - CANUSPAC exercise, Vancouver;
    - October - AMOCO spill near Rocky Mountain House, Alberta;
    - October 10-25 - Nov. 2-4, Rio Orcono Incident, Anticosti;
    - October 25 - Diesel Fuel Spill, James Bay;
    - December 7 - Sulphur Trioxide Incident, San Salvador;
    - December 13, 15 - Bunker C leakage from Irving Whale, P.E.I.;
    - January 11 - May 8, Burning of Gulf Crude Oil;
    - January 25 - March 31, Gulf Oil Spill;
    - March 13 - Use of Lorcon Foam on Fire, Nova Scotia.

8. With support from PERD, DFO, U.S. Minerals Management Service, and the American Petroleum Institute, Barringer Research constructed and bench tested a prototype laser fluoresnsor for oil spill remote sensing.

9. A draft Shoreline Cleanup Advisory Team (SCAT) manual for oilspills in the Pacific Northwest was completed - which will serve as a model for other geographic areas.

10. A technical workshop was convened and a "concept" report and preliminary experimental design were prepared for the proposed Pacific Coast (experimental) Oil Spill (PCOS) Project.

Emergencies Engineering Division (EED)

EED undertakes engineering research, development, and demonstration work on technologies for cleaning up contamination caused by pollution emergencies or insecure hazardous waste sites.

This work includes R&D on sorbents and containment/recovery/disposal equipment for response to oil and chemical spills in marine and non-marine environments. It also includes the development, dissemination, and use of testing protocols for evaluating spill-response equipment in the laboratory and the field.

The Division develops and maintains a range of prototype clean-up equipment which is used, in co-operation with others, to demonstrate and adapt innovative methods for on-site mitigation of water or soil contamination which is difficult to handle using convention techniques.

The Division serves as the primary centre of specialized engineering advice on pollution emergency clean-up to the regions and others. For spills of national concern, this role can include direct involvement in clean-up operations through the provision of on-site expertise and mobile water-or soil-decontamination equipment.

EED Highlights

1. Progress was made on a new series of sorbent test protocols in conjunction with the Canadian General Standards Board (CGSB) and the American Society for Testing and Materials (ASTM). The long term objective is to have a common North American test protocol.

2. As a result of EED's testing, enhanced oxidation was selected for long term remediation of contaminated groundwater at the Gloucester Landfill.

3. A new edition of the "World Catalogue of Oil Spill Response Products" was produced in co-operation with U.S. Minerals

Management Service (U.S. MMS) and the U.S. Coast Guard (USCG).

4. A series of joint clean-up projects with industry were carried out. This work, which involved both membrane technology and enhanced oxidation, greatly increased EED's data bank on technologies for treating contaminated water.

5. Harry Whittaker was a member of a Canadian Assessment Team sent to Bahrain and Qatar following the Persian Gulf oil spill.

6. Harry Whittaker chaired 2 meetings of the ASTM Committee F-20 on oil and chemical spill response. Lisa Keller attended both meetings and is leading the sub-committee involved in setting new guidelines for the use of membranes in spill cleanup and a new test protocol for sorbents.

7. Bench-scale studies demonstrated that hexane and natural gas condensate are as effective as proprietary solvents for the removal of spilled oil from soil matrices.

8. In collaboration with the U.S. MMS, a draft protocol was completed for standardized testing of oil-spill booms.

Pollution Measurement Division (PMD)

PMD is responsible for co-ordination of the operations of the National Air Pollution Surveillance (NAPS) Network consisting of 380 air monitoring instruments at 130 sampling stations located in 52 major urban areas in Canada.

The Division also evaluates and develops new ambient air pollution measurement technology in support to the NAPS network and priority issues such as LRTAP, Toxics and the NO_x*/VOC plan.*

Source monitoring activities include: development and update of Reference Methods for measurement of emissions from stationary sources in support of CEPA Regulations and Guidelines; development of new emissions measurement methods in response to emerging priority issues; evaluation of commercially available monitors to measure stack emissions on a real-time basis; application of emissions measurement methods at source to satisfy the Department's need for information for a variety of purposes.

PMD Highlights

1. The second NAPS Operations Seminar held in Halifax was organized with the participation of the Ambient Section staff and representatives from all NAPS agencies.

2. The 1989 NAPS annual data report with the addition of sulphate and nitrate data and the monthly summaries from January 1990 were generated from the NAPS M204 data base. Uploading and validating of monthly and annual NAPS data reports, extract and inquire procedures were completed.

3. The third NAPS interlaboratory testing program was completed. The results were analyzed and a summary report was distributed to participating agencies. The results were discussed in the NAPS Seminar held in Halifax.

4. In support of the C&P Ontario Region ambient air monitoring program for the Greater Detroit Resource Recovery Authority (GDRRA) incinerator, the Windsor University Avenue and Walpole Island monitoring stations were maintained and supported during 1990/91. A second Windsor site (College/Prince Street) was established in June 1990.

5. An Environment Canada/United States Environmental Protection Agency (U.S. EPA) Interagency Agreement was negotiated in conjunction with the Ontario Region. The agreement will result in EPA carrying out chemical mass balance analyses of the Windsor/Walpole inhalable particulate and VOC data to assist in determining major emission sources.

6. Over a hundred requests for air toxics data from government and non-government agencies were filled.

7. A summary report containing all available Canadian data on ambient air PAH measurements was compiled for the Quebec Region in support of the PAH assessment. An analysis of the relative toxicity of PAH samples from various sites was carried out and a report prepared for Quebec Region and Health and Welfare.

8. Assistance was provided to Health & Welfare and External Affairs in evaluating air quality in cities with Canadian embassies or consulate offices.

9. Ambient air sampling for volatile organic compounds (VOC) is being carried out at nineteen urban sites and one rural site across Canada. A total of 130 different VOC species are being identified and quantified.

10. An extensive PC-based air toxics data base has been established and is updated regularly as results flow in from the field measurement programs. Numerous programs have been developed to allow output of summary statistics and for data display.

11. Work continued on the Canadian Council of Ministers of the Environment (CCME) sponsored co-operative R&D project on ambient dioxin sampling and analysis. Activities included a

workshop, an inter-lab comparison involving eighteen Canadian and United States laboratories and sampling and analytical method write-ups.

12. There was extensive involvement in the drafting of the final version of the NO_x/VOC Management Plan for Canada including the preparation of the monitoring and data analysis chapters and appendices.

13. A workgroup meeting in Geneva was attended in support of the negotiation of an international VOC protocol under the auspices of the UN-ECE. The meeting involved a reactivity weighting approach to calculating VOC emission reductions. Extensive analysis of Canadian ambient and source VOC data was carried out in preparation for the meeting.

14. In co-operation with IPB and Quebec Region, PMD chaired a joint federal/provincial/industry technical working group to address the industry's request to modify an existing asbestos Reference Method (EPS 1-AP-75-1). PMD provided the working group with a method comparison study proposal which formed the basis of a jointly funded field testing program. Tests were conducted at several asbestos operations in the province of Quebec. PMD performed QA/QC (including on-site witnessing), reviewed the test results, and submitted a summary report on the testing program.

15. PMD continues to assist IPB in the promulgation of the CEPA Federal Industrial Boilers Emission Control (FIBEC) regulations by providing technical advice to the FIBEC Task Force in matters pertaining to emission measurement, by developing and publishing Reference Method EPS 1/RM/15 in support of the regulations, and by reviewing the draft regulations to ensure its compatibility to the RM.

16. To support source-related projects initiated by other C&P responsibility centres, PMD continues to develop and update technology transfer documents, such as the Technical Assistance Bulletin (TAB) and stack testing witnessing forms. PMD staff continue to serve on the American Society for Mechanical Engineers (ASME) PTC-45 Committee to develop and standardize protocols for the testing of municipal wastes incinerators.

17. Several regional CEPA inspectors responsible for the compliance and enforcement of emission regulations were field-trained on the basics of sampling and on-site witnessing.

18. PMD completed discussions with IPB, RAPIB, Legal Services, and other C&P responsibility centres on a process to formalize the co-ordination of regulation promulgation activities and method development work.

19. Reference Method EPS 1/RM/4, originally developed for monitoring CO emissions from oil refineries, was published in support of the proposed CEPA Non-hazardous Solid Wastes Incinerators Regulations and the CCME Guidelines for Municipal Solid Wastes Incinerators

20. A document entitled "*A Method for Measuring Particulate Emissions from Stationary Sources with Cyclonic Flow Pattern - Alignment Method*", was drafted and forwarded for review to the Joint Environment Canada/BC MOE/Alberta Environment Technical Committee on Cyclonic Sampling.

21. A document entitled "*Development of a Calibration Apparatus for a Continuous Water Vapour Emission Monitoring System Used during NITEP-3*" was drafted and reviewed. Meetings were held with the 3T Division to discuss the potential for intellectual property licensing.

22. PMD was extensively involved with the Ontario Region (OR) in the implementation of Environment Canada's National Inspection Plan. Compliance testing at four Ontario operations (Tonolli, General Motors, Gates, and Canada Metals) were witnessed under the auspices of the CEPA Secondary Lead Smelters Regulations.

23. Technical support was provided to the P&Y Region in a case against a barge incinerator burning ship wastes in the harbour of Vancouver.

24. PMD continued to provide technical support to the Waste Management Branch and other participants of the project *Multi-Party Mobile PCB Incinerator Demonstration Project (Vesta at Swan Hills).*

25. PMD participated in a multi-party USA-Canada program to evaluate whether vitrification is a feasible technology for the pre-treatment of MSW incinerator ash prior to its disposal at landfills.

Mobile Sources Emissions Division (MSED)

The MSED conducts the vehicle emissions testing for the federal government's compliance audit program for new light duty vehicles offered for sale in Canada. This joint Transport Canada / Environment Canada program evaluates new vehicles for exhaust / evaporative and particulate mass emissions to determine compliance with standards and regulations under the Canadian Motor Vehicle Safety Act.

The MSED investigates alternative fuels and alternative engine technologies to determine the potential impact on Canadian air quality and to provide emission factors for predicting total national emissions.

The MSED undertakes joint government/industry programs to develop new technologies or optimize existing equipment which will result in performance improvements, and energy and emission reduction.

The facility conducts testing programs to update the Canadian fleet emissions estimates, including work on in-use vehicle monitoring, effects of ambient temperature conditions, and results of emissions-control tampering. As a result of testing of this nature, the government develops regulations and guidelines to protect the Canadian environment more effectively.

The MSED provides a unique technical advice and assistance program which includes limited testing for industry. The program includes evaluation of fuel-saving devices and the provision of assistance to the general public, governments, industries, and institutions.

MSED Highlights

1. **The MSED conducted a pilot project to develop the instrumentation for the measurement of in-vehicle emissions in congested freeway traffic. A test project was conducted using this instrumentation, in both Ottawa and Toronto, under hot summer conditions. The results indicated notably higher concentrations of a number of measured emissions in relation to the ambient air samples collected in surrounding locations.**

2. **The laboratory completed the 1990 model year light duty vehicle compliance audit program. A total of 45 vehicles were tested resulting in 6 models being noncompliant and/or not meeting the specified fuel consumption ratings.**

3. **The MSED participated in the "World of Wheels" cross-Canada rally for alternative fuels by conducting exhaust emission evaluations including speciation of the hydrocarbon compounds. The results indicated that an alternative fueled vehicle can be as efficient and 'clean' as existing gasoline vehicles.**

4. **The laboratory participated in a joint collaboration with Alupower Inc (Alcan) to evaluate the performance and emissions from an aluminum/air fuel cell, which in this case has been developed as a range extender on an electric vehicle.**

5. **A sampling system was developed for the analysis of exhaust emissions from low speed, large displacement diesel engines used to propel marine vessels. This system was used in a joint MSED/Coast Guard pilot project to measure the exhaust emissions from the diesel propulsion engines of the CGS Griffin, a 3000-ton, class-3 ice breaker.**

6. **The laboratory conducted a test project to investigate the effects of ambient temperatures on the performance of a production electric vehicle powered by lead/acid batteries.**

7. A series of state-of-the-art technology light and heavy duty vehicles using alternative fuels and power plants were evaluated for performance and emissions.

These vehicles included	Collaborators
a) Natural gas converted 1990 Chevrolet Lumina	ICG
b) Methanol 1991 Chevrolet Lumina	EMR/GM
c) Flexible fuel methanol 1990 Ford Taurus	Ford
d) Propane converted 1990 Taurus	PGA/Ford
e) 1990 neat methanol MCI urban transit bus	Medicine Hat
f) 1989 electric G-van	Conceptor (Magna)
g) 1990 electric Caravan (aluminum/air)	Alupower
h) 1990 Navistar class 7 truck/trailer	Navistar

8. A series of urban transit buses were evaluated to speciate the exhaust, determine the effects on exhaust emissions/fuel consumption as a result of varying the engine maximum horsepower and to compare engine certification testing to chassis dynamometer vehicle testing.

Director's Office

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Direction, Management & Support 2060-3300-67100

Project Manager: D. Thornton (613-991-9550)

Objective

To ensure efficient and cost-effective delivery of RRETC programs.

Relevance

Efficient provision of hands-on, specialized technical support and R&D in the areas of air pollution measurement and environmental emergency countermeasures technology are necessary to support the departmental programs relating to environmental protection.

Work Plan

1. *Develop operational and work plans for the Centre.*
2. *Prepare regular activity reports including an annual activity report.*
3. *Provide functional administration and computing support.*
4. *Oversee the operation, maintenance, and up grading of the building and associated services.*
5. *Undertake special projects as necessary.*

Status Report - March 31, 1991

1. **Plan developed and submitted.**
2. **Quarterly "Synopsis Reports" prepared, and annual activity report for FY1989-1990 completed, and other activity summaries prepared as required.**
3. **Central computing expertise maintained.**
4. **With support from Finance & Administration Branch, a detailed one-year Operations & Maintenance contract was negotiated with Public Works Canada, including the development of a on-site computerized Preventative Maintenance Support System. In addition, numerous facility improvement projects were started or completed during the period, including: roof repair (one-third);**

boilers replaced; sprinkler system and fire walls installed; new car park for emission-test vehicles; reconfigured High-hazard laboratory (one-half completed); and improved security systems.

5. Co-ordinated the development of the concept of using the Level of Quantitation for the "virtual-elimination" control limit for PCDD/F in pulp & paper effluent. Coordinated, on an emergency basis, the analytical work performed on samples from the Ste. Amable Tire Fire. Acted as initial departmental spokesperson on the Persian Gulf oil spill and coordinated the development of a project to survey the coasts of Bahrain/Qatar and to train local officials in shoreline cleanup. Coordinated the QA analyses of blood samples collected from people exposed to smoke from the VESTA PCB mobile incinerator during tests at Swan Hills, Alberta. Coordinated the Preparedness/Response element of the Internal Marine Spills Review which involved preparation of briefing documents (departmental and federal position papers, resource estimates/action plan items etc.), negotiations with OGDs, and presentations to the Public Review Panel - including the redrafting the Research & Technology Development Chapter of the Panel's final report. In response to the Panel's recommendations on marine spill R&D, the committee structure/network for spill R&D coordination in North America was revitalized and a related conference paper prepared and delivered to oil industry leaders. Various submissions, estimates, and justifications were developed for input to the Green Plan - including material for: Marine and Non-marine Emergencies; Toxics; NO_x/VOC; Integrated Monitoring; LRTAP; Enforcement; and S&T ("Revitalization").

Safety and Health 2060-3300-67110

Project Manager: D. Thornton (613-991-9550)

Objective

To ensure delivery of RRETC programs in a way which protects human health and safety.

Relevance

The protection of RRETC staff and others during program delivery is essential for humanitarian, policy, and legislative reasons.

Work Plan

1. *Implementation of WHMIS legislation.*
2. *Implementation of the provisions of the Emergency Response Plan.*
3. *Coordinated collection and disposal of chemical wastes.*
4. *Environmental audit of RRETC.*
5. *Effective Safety and Health Committee.*

Status Report - March 31, 1991

1. The requirements of WHMIS were implemented through posting of Material Safety Data Sheets, WHMIS initial and refresher training sessions for staff, in-house contractors, and students, and up-dating of the building-wide chemical inventory.
2. The Emergency Response Plan was distributed to all staff and provisions followed during evacuation exercises and false alarms.
3. Central coordination of disposal of lab chemical wastes was maintained through the Building Waste Disposal Coordinator and a contract with a licensed waste-disposal company.
4. The final report on the RRETC environmental audit was received and an Action Plan drafted in response. The Action Plan was approved and work initiated. A status report on the delivery of the Action Plan was prepared and submitted to management.
5. S&H Committee meetings were held monthly, and a regular newsletter on activities, tips, etc. prepared by the committee.

Biological Testing Development & Use

2060-3200-67120

Project Manager: G. Sergy (403-468-8039)

Objective

To enhance the quality, application, acceptance and effective usage of biological tests and test data by C&P nationally.

Relevance

Supports implementation and enforcement of Departmental and national legislation and policy; provides nationally consistent methodology and quality, environmental regulation control standards; environmental assessment procedures, integrated multi-disciplinary appproach to toxic substance management.

Work Plan

1. *Biological Testing Methods Standardization. Continue a multi-year program for development and publication of "Environment Canada, Aquatic Biological Test Methods" with priority on standards required by the Fisheries Act -Effleunt Regulations, CEPA-new and existing substances and ocean dumping provisions.*
2. *Biological Testing Applications and Capability. Develop and promote a program to meet the biological testing requirements for C&P's regulations and toxic substance management framework.*
3. *Regulation Development. Support regulation development through the provision of standardized reference methods and QA/QC, advice on appropriate test types, use and protection criteria.*

Status Report - March 31, 1991

1. (a) Published and distributed each of three generic acute lethality testing methohdoliges required for the Fisheried Act and CEPA (rainbow trout, daphnia, and threespine stickleback).

   (b) Published and distributed each of two effluent-specific Reference Methods for the Pulp & Paper Regulations (rainbow trout and daphnia)

   (c) Published and distributed guidance document on refernce toxicants.

   (d) Complted internal and external review of drafts of three sublethal testing methodloliges (Ceriodaphnia-life cycle; fathead minnow larval growth and Microtox) required by the Fisheries Acts and CEPA.

   (e) Completed initial draft review, conducted interlab testing for development of a marine amphipod sediment lethality test for Ocean-dumping provisions.

2. (a) Prepared and presented to various audiences, a program plan tomeet new and on-going program needs.

   (b) Facilitated C&P laboratory co-operation and co-ordination, in conjunction with other EPBranches and Regions, with respect to the research, development, quality and provision of ecotoxicological methods and approaches.

(c) Represented TDB on the Inter-Governmental Aquatic Toxicity Group.

3. (a) Advised IPB, reviewed and prepared material on the toxicity provisions of vatrious drafts of the proposed pulp and paper effluent regulation.

(b) Developed a pilot electronic reporting format and recipient database for compliance reporting of toxicity information required by the proposed pulp and paper effluent regulation.

Chemistry Division (CD)

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Organic Analysis / Methods 3200-67600

Project Manager: C. Chiu, (613) 990-8560

Objective

Provision of trace and ultra-trace organic analyses on a variety of samples including ambient air, source emission (stack) and vehicle emission samples; industrial process feedstocks, ashes, wastewaters and leachates; oils, soils, sediments and groundwater; and other matrices of environmental concern. Samples are generally analyzed for a number of constituents such as chlorinated dioxins an furans (PCDD/PCDF), polychlorinated biphenyls (PCB), chlorinated benzenes and phenols (CB, CP), polycyclic aromatic hydrocarbons (PAH) and other aliphatic and aromatic compounds. New analytical methods are developed in support of regulations for specific pollutants and existing protocols are refined to ensure validity of reported results produced from service analyses.

Relevance

Dioxins and furans are among the most toxic chemicals known and, along with other chlorinated organic compounds such as PCB's, chlorinated benzenes and chlorinated phenols, can pose serious environmental threats. Other organics like PAH's are known carcinogens. Accordingly, there is considerable concern in the general population over the hazards of such substances to health, property and the environment. Such toxic organic substances can be produced from a variety of industrial processes and can also be of environmental concern in waste dump sites or accidental spill situations. Accordingly, there is a need for timely and accurate analysis of such compounds and research on methods of measurement and removal of such substances from the environment.

Work Plan

ANALYSIS:

601 Continue analysis of Windsor/Walpole ambient air samples for PCDD/F, PCB, CB, CP and PAH.

602 Continue PAH analysis of ambient air samples from the expanded NAPS network at Hamilton, Toronto, Montreal and Arvida sites.

603 Provide QA/QC support and analyses to Ontario Region for the additional Windsor site for semi-volatile organic analyses.

604 Provide QA/QC support and analyses to Quebec Region for an ambient air PAH study in Quebec.

605 Continue to provide analyses and QA/QC support to the federal government's PCB burn at Goose Bay, Labrador.

606 Continue analyses of PAH and N-PAH on NBS study of oil burn residues in collaboration with EETD.
607 Analysis of crude oil and soot samples for PAH to evaluate the shoreline cleanup technology.

608 Provide analysis of PAH, N-PAH, PCDD/F on vehicle emission studies in collaboration with VETL.

609 Participate in round-robin studies on organic analysis.

610 Provide analyses or other technical support to CEPA regulatory and enforcement actions as they evolve.

611 Provide QA/QC support and analyses to P&Y Region on Ocean Dumping.

612 Provide emergency organic analysis and QA/QC support for spills or other environmental incidents. Our capacity to respond to these requests is very limited.

METHODS:

620 Complete reference method for the analysis of dioxins in pulp mill effluents using Hi-Res MS technique.

622 Continue development of software for automated quantitation of PCB.

623 Evaluate automated apparatus for extraction of dioxins and PCBs.
624 Evaluate Supercritical Fluid techniques for extraction of dioxins and PCBs from complex matrices.

625 Develop, modify or refine analytical methods for other organic compounds as required.

626 Participate as a member of Dioxin QA Advisory Committee in developing of standard dioxin QA protocols.

627 Participate in developing of CRM for dioxin in sediment.

ADVICE/SUPPORT:

630 Provide technical advice on organic analytical principles, procedures and instrumentation as required.

631 Review technical proposals for contract analytical work, provide advice on appropriate methods and recommend appropriate QA/QC protocols.

632 Attend courses, conferences and technical meetings to keep abreast of the latest developments in environmental analytical chemistry.

Status Report - March 31, 1991

ANALYSIS:

601 A total of 258 ambient air samples from Windsor and Walpole sites were analyzed for SVOC. High-Res MS was used for PCDD/F analysis because of the extremely low level (less than 10 Pg/M^3) of target analytes and the relatively high level of organic matrices in samples.

602 A total of 160 ambient air samples from 4 NAPS sites were analyzed for PAH.

603 (a) Analytical support was provided for the additional Windsor site;

(b) Completed the analysis of 48 samples from Domtar/Northern Wood Preservers for PCDD/F.

604 Several sets of QA samples were forwarded to a contract lab for PAH analysis.

605 In support of the Goose Bay PCB incineration project, Chemistry Division provided reference protocols, monitored the performance of the contract lab and analyzed a total of 43 emission and QA samples for PCB, PCDD and PCDF.

606 In collaboration with Emergencies Science Division (ESD), 14 oil/soot samples from oil-burning tests were analyzed for PAH.

607 At the request of Emergencies Engineering Division (EED), 5 groundwater samples were analyzed for PCP and 5 wastewater samples were analyzed for PCDD/F to assess the effect of UV destruction on dioxins.

608 In collaboration with Mobile Sources Emissions Division (MSED), 47 emission samples collected from OC Transport buses were analyzed for PAH.

609 (a) Participated in NWRI's round-robin studies for organics in sediments, defoamer agents and solvents.

(b) Participated in EPA's method validation study for PCDD/F in extracts of pulp and paper mill effluents.

(c) Participated in the second ambient air interlab study sponsored jointly by Ontario MOE and RRETC.

610 At the request of Quebec Region, QA/QC protocol and audit samples were provided to contract lab and several QA samples were analyzed for the study of PCDD/F emissions from Montreal Municipal incinerators.

611 No activity.

612 No activity.

METHODS:

620 (a) A fourth draft of the reference method for the determination of PCDD/F in pulp and paper mill effluents was prepared.

(b) In collaboration with the Pulp & Paper Research Institute, four pulp mills were selected for sample collection A total of 700 1-L effluent samples were collected for an upcoming interlaboratory study to determine the level of Quantification (LOQ) and validate the proposed reference method. Homogeneity tests for the effluent samples were completed.

622 No activity - staff and time shortage.

623 An automated sample cleanup apparatus (EMS) using alumina and carbon columns was set up and evaluated for efficiency, recovery, reproducibility and possible contamination.

624 No activity - staff and time shortage.

625 (a) Various cleanup methods for analyzing PCB in transformer oil using GC/MSD were evaluated. A two-stage adsorption chromatography using activated basic alumina has been optimized to handle transformer oil and other oil matrices.

(b) Several chromatographic methods for the fractionation of nitro-PAH were evaluated. NBS reference materials were used for the study. A comprehensive study report was prepared.

(c) Chemistry Division chaired a joint federal/industry analytical working group to identify areas that need to be updated for vinyl chloride regulation.

626 Completed a 4th draft of the dioxin quality assurance protocol for the DQAAC. This document has been distributed to commercial laboratories and members of the C&P Lab Manager's Committee for review and comment.

627 In collaboration with NWRI for developing certified reference materials, 15 replicate samples of sediment were analyzed for PCDD/F.

ADVICE/SUPPORT:

630 Technical information and advice on toxic organic analysis were provided, upon request, to municipal, provincial and federal government agencies, and private organizations.

631 Technical advice was provided to:

(a) Research proposal on "Development of PAH Reference Standards".

(b) Research proposal on "Evaluation of the Impact of Diesel fuels on Particulate, PAH and Nitro-PAH Emissions".

(c) Report on "CPPA National Dioxin Characterization Program".

(d) Report on "Dioxin in Lube Oil Samples".

632 (a) C. Chiu attended the Dioxin '90 Conference, September 10-14, Bayreuth.

(b) R. Halman attended the 42nd Pittsburgh Conference, March 4-8, Chicago.

(c) G. Poole and R. Halman completed the 3-day course "Quality Assurance for the Analytical Laboratory", February 27-March 1, Chicago.

(d) G. Poole and K. Li completed the 4-day course "Fundamentals of Supervision", December 10-14, NCR.

(e) M. Tardif completed the 5-day Inspector Training Seminar, May 7-11, Kingston.

(f) M. Lanoy attended a workshop on Trace Organic Analysis by Mass Spectrometry, November 13-14.

Inorganic Analysis / Methods 3200-67650

Project Manager: J. Dlouhy (613-990-9359)

Objective

Provision of inorganic analyses of samples from the National Air Pollution Surveillance (NAPS) network; from special ambient air and source emission (stack) testing studies; from retail gasoline sampling tests and other programs of environmental significance. Sample matrices include *filters, solutions, process feedstocks and ashes, gasolines and other commercial products which are analyzed for a variety of components such as common anions (SO_4, NO_3, F, Cl, PO_4, NO_2), toxic metals (Pb, Hg, As, Se) and simultaneous multiple-element (40) assays of dichotomous filters. New analytical methods are developed in support of regulations for specific pollutants and existing protocols are refined to ensure validity of reported results produced from analysis.*

Relevance

The NAPS network is used to collect data on ambient air pollution levels in urban centres across Canada. Special ambient air surveys are also conducted to measure levels of toxic inorganics identified under CEPA. Data on levels of inorganic compounds, such as nitrates and sulphates, can be used to delineate the extent of the acid rain problem in Canada and such data can supplement other important studies like the long range transport of air pollutants, which have both regional and international implications.

Work Plan

ANALYSIS:

651 Analyze NAPS Hi-Vols for lead , SO_4/NO_3 and arsenic.

652 Analyze NAPS Dichot filters for SO_4/NO_3, other common anions, and for 40 toxic metals and elements.

653 Analyze NAPS SSI filters for lead and SO_4/NO_3.

654 Analyze inhalable particulate filter samples (Dichot) for SO_4/NO_3 and multi-element assay of 40 metals and elements as part of Windsor/Walpole studies.

655 Analyze Dichot filter samples for 40 elements as part of a special ambient air study in Cornerbrook, Newfoundland in support of Newfoundland Department of Environment and Lands.

656 Provide QA/QC support to Mobile Sources Emissions Division for inorganic analysis.

657 Analyze gasoline samples submitted by regional offices to determine compliance with leaded gasoline regulations.

658 Provide inorganic analyses for small projects that develop throughout the year.

METHODS:

670 Continue development/refinement of methods for SO4/NO3 and other anions and multi-element analyses by EDXRF and Ion Chromatography.

671 Continue participation in inter-lab QA studies with USEPA, Alberta Research Council, NRC and CCIW.

672 Maintain QA charts for tracking performance of production analysis methods.

ADVICE/SUPPORT:

680 Provide technical advice on inorganic analytical principles, procedures and instrumentation as required.

681 Review technical proposals for contract analytical work, provide advice on appropriate methods and recommend appropriate QA/QC protocols.

682 Attend courses, conferences and technical meetings to keep abreast of the latest developments in environmental analytical chemistry.

683 Maintain lab facilities and equipment that are often seriously compromised by power failures and inadequate ventilation and humidity control for critical equipment.

Status Report - March 31, 1991

VISITS:

The laboratory was visited by different people:

(a) Dr. David Wren (AECL, Whiteshell);

(b) Jim Grant (Dionex) twice;

(c) Louis Pinaude (University of Waterloo) three times;

(d) Dr. Len Good, Deputy Minister, EC;

(e) Two high school students (in place of 12) during Chemistry Week program;

(f) Dr. Valeri V. Tarasov, Mendeleev Institute of Chemical Technology, Moscow, USSR;

(g) Environmental Auditors.

SAFETY:

(a) Special medical examinations for radiation workers were secured for three employees at the Government Health Centre.

(b) Fume hoods air face velocity was measured and recorded.

(c) Laboratory safety inspection forms were prepared, tested and modified.

(d) All three CO-OP students from the University of Waterloo attended the laboratory Safety Seminars and the WHMIS seminars at RRETC.

ANALYSES:

All major results are now transferred to customers using EPD.

651-
654 A large amount of analysis was performed mainly in support of the NAPS network. The statistical summary is in the next table.

655 Project was completed. Reports were transmitted to the customer.

656 No activity.

657 No activity.

658 (a) Fuel economy device core was extensively, internally and externally, analyzed and a report generated.

(b) CEPA - analysis of lead in samples from secondary lead smelters for Ontario Region.

(c) HCl and particulate analysis of samples from CFB Goose Bay, Labrador.

METHODS:

670 (a) Additional Ion Chromatography equipment was installed, tested and used, to reduce the backlog of samples.

(b) New EPA method 7D for the determination of NO_x was extensively tested in cooperation with Pollution Measurement Division. A report was written.

(c) The first version of the error estimation in forty elements XRF determination for EPA cooperation in Windsor/Walpole project was finished.

(d) The new version of the software for the X-ray spectrometer (Kevex) was installed, including the necessary hardware changes.

671 (a) CEPA Canadian General Standards Board - Lead in Gasoline round-robin organized by Alberta Research Council continues.

(b) CEPA, Canadian General Standards Board - Manganese in Gasoline round-robin organized by Alberta Research Council started.

(c) CEPA, Canadian General Standards Board - Stability of Lead and Manganese in Gasoline started.

(d) Agriculture Canada, Dr. M. Ihnat - participation in the international round-robin to establish the parameters of new standards.

672 (a) The QA charts are prepared for all X-ray fluorescence (Kevex), Ion Chromatography and Photometry results.

(b) Reporting of QA results to customers.

ADVICE/SUPPORT:

680 (a) Advice on Ion Chromatography to C. Gilette-Welling by D. Mathieu and S.H. Ritchie.

(b) Advice to Y. Stokker (CCIW) on the extraction methods for the recent sediments round-robin by S.A.H. Ritchie.

(c) Advice to P. Haulena (Accutest Laboratories) on nitrate analysis using Technicon Autoanalyzer by S.A.H. Ritchie.

(d) Advice to P. Haulena (Accutest Laboratories) on MTB and other problems in sulphate and nitrate analysis using Technicon Autoanalyzer by Dr. Dlouhy and S.A.H. Ritchie.

(e) The method on the determination of fluoride was sent to R. Blais (OR) at his request by S.A.H. Ritchie.

(f) Advice and demonstration of the ion chromatograph (Dionex upgraded model 14) to Dr. Z. Wang (ESD) by N. Houle.

(g) CEPA - Preliminary meeting of S.A.H. Ritchie with Ontario Region personnel and P.K. Leung (PMD) at the ICI Forest Products chlor-alkali plant in Cornwall, Ontario, to discuss and prepare the plant mercury inspection.

(h) Witnessing of the inspection described in (g) above, by S.A.H. Ritchie.

681 No activity.

682 (a) Dr. Dlouhy attended the Environmental Video Teleconference on Newest Analytical Methods and Techniques, Ottawa.

(b) Dr. Dlouhy attended a meeting on the formation of Analytical/Environmental Centre at Carleton University.

(c) Dr. Dlouhy attended the official opening of the Environmental Services Laboratory of Bondar-Clegg Company, Ottawa.

(d) Dr. Dlouhy attended the annual meeting of the Ottawa section of the Spectroscopy Society of Canada.

(e) Dr. Dlouhy attended the 39th Annual Denver Conference on X-ray Analysis in Steamboat Springs, Colorado.

(f) Dr. Dlouhy attended the NOx/VOC meeting at RRETC.

(g) Dr. Dlouhy attended the AES meeting in Toronto.

(h) The Task Force 2000 and Green Plan meetings at RRETC were attended by all employees.

(i) S.A.H. Ritchie attended the three-day course on the Transportation of Dangerous Goods at RRETC.

(j) N. Houle attended the statistical course on Scientific Data Analysis at PVM.

(k) N. Houle attended three-day First Aid and CPR course at RRETC.

(l) N. Houle and S.H. Ritchie attended two-day course on Stack Sampling Safety at RRETC.

(m) N. Houle, D. Mathieu and S. H. Ritchie attended the Computer Show, Ottawa.

(n) N. Houle, D. Mathieu attended Ottawa Business Show, Ottawa.

(o) D. Mathieu attended Mitsubishi and Corel seminars on optical disk drives in Ottawa.

(p) All three CO-OP students from University of Waterloo attended the Laboratory Safety seminars and WHMIS seminars at RRETC.

683 (a) There were frequent water leaks in almost all laboratories which endangered or damaged expensive equipment. In order to protect the equipment, an acceptable solution for the appropriate individual's protection was designed and partly implemented. It is still missing on the Ion Chromatograph and Atomic Absorption Spectrometers.

(b) There were also frequent power failures, which in some cases, originated from within the building. S.A.H., Ritchie was called back each time to reset all fume hoods in the building. Some damage to the equipment was caused by the power failures, especially the X-ray tubes which failed, resulting in direct damage of over $20,000.

(c) The possibility of purchasing an older working X-ray spectrometer (Siemens, model VSR) from Queen's University was considered and rejected.

(d) Regular weekly maintenance on XRF spectrometer (Kevex) is proceeding.

(e) Regular monthly maintenance on Haskriss chiller is proceeding.

SAMPLES ANALYZED BY INORGANIC LABORATORY
April 1, 1990 - March 31, 1991

Statistics	Fiscal Year	Monthly Average
New Samples Processed	5 324	444
Samples Completely Processed	5 788	482
Total Analyses Performed	83 415	6 951
By XRF Kevex	55 560	4 630
By XRF Siemens	2 301	192
- QA/QC	43	4
By IC	22 025	1 835
By AA	56	5
By HGAA	59	5
- QA/AC	27	2
By TECH	2 968	247
- QA/QC	340	28
By SIE	0	0
By GRAV	0	0
By OTH	36	3

Note: This table does not include calibration, standards or QA/QC samples analyzed, unless reported to the customer.

Legend:

XRF = X-ray Fluorescence
IC = Ion Chromatography
AA = Atomic Absorption
TECH = Technicon Automated Colorimetry
SIE = Specific Ion Electrode
GRAV = Gravimetry
HGAA = Graphite Furnace AA
QA/QC = Quality Assurance/Quality Control
OTH = Other

QA/QC Activities (FPACAQ) 3200-67700

Project Manager: B. McDonnell, (613) 990-4967

Objective

To design and administer an interlaboratory testing program, by supplying samples, standard reference materials, analytical methods and advice to laboratories of the FPACAQ as well as to commercial and academic laboratories.

To provide advice to other national and international agencies concerning the availability of standard reference materials for use in environmental analysis, and to assist in the development and evaluation of QA protocols for EP-administered contracts and methods.

Relevance

In order to improve and document the reliability of environmental measurements, quantitative measures of laboratory performance are required. Interlaboratory studies yield sufficient data to allow statistically valid performance standards to be established for analytical work.

Work Plan

701 Complete a poll of FPACAQ laboratories for candidate pollutants for the next three years.

702 Complete and report on round-robin for PAH in waste crankcase oils.

703 Complete a second NAPS-related survey on SO_4/NO_3.

704 Provide technical advice and support on analytical principles, procedures and instrumentation related to interlaboratory testing programs, as required.

705 Attend courses, conferences and technical meetings to keep abreast of the latest developments in environmental analytical chemistry.

Status Report - March 31, 1991

701 The list of projects was drawn up and the lab will be contacted upon approval by management of the proposed projects .
702 No round-robin initiated.

703 The survey report is still being reviewed. One review was completed by the QA group, NWRI.

704 Technical advice supplied to:

(a) EETD - installation of an A.A. spectrometer.

(b) Edgar Lachance - scientific database access from RRETC to Environment Canada library, NRC library (DOBIS), CAN/OLE, etc.

(c) Medical associations were contacted with regard to the analysis of nitrate and phosphate (reported species as possibly being nitrogen or phosphorus).

(d) Health and Safety - memos regarding (i) falling objects during installation of sprinkler system; (ii) 1985 MOE laboratory safety manual.

705 No activity.

706 A review of the interlaboratory testing program was completed for Dr. Thornton.

707 A general technical review of interlaboratory testing for proficiency testing and for analytical method validation was initiated.

Management 2200-67750

Project Manager: M. Bumbaco (613) 990-8559

Objective

Management of the financial and human resources of the Division and development and implementation of policies to ensure safe and productive laboratory operations.

Relevance

Requests for support and advice on complex analytical procedures originate from various C&P RCs as well as other government *departments, national and international agencies. Such support is of major significance in our laboratory because of the increasingly high profile and attention being focussed on toxic chemicals in the environment.*

Work Plan

751 *Provide direction and manage human and fiscal resources of the Chemistry Division.*

752 *Plan and direct expenditures necessary to maintain Chemistry Division lab operations including travel funds, equipment maintenance and repair, service contracts, contracted help, capital purchases and other administrative costs.*

753 *Prepare regular reports on Divisional activities, develop work plans and provide inputs to the RRETC communications plan and other planning processes, as required.*

754 *Continue to implement a Lab Safety Plan for the Division, continue routine analysis of solvent wastes and provide technical assistance in the development of a comprehensive chemical and waste management plan for RRETC.*

755 *Undertake a program review to clarify the linkages, role and function of the FPACAQ QA/QC program in Chemistry Division.*

756 *Continue participation in meetings and programs of C&P Lab Manager's Committee.*

757 *Participate as a member of CGSB Committee on Petroleum test methods.*

Status Report - March 31, 1991

751 A number of previous in-house contractors were hired as term employees in the mid-year. This has helped considerably in easing the problem in continuity of expertise in the Organic and Inorganic laboratories.

752 (a) As in previous years, the Division's A-Base budgets were expended within the first three months of the year.

(b) The A-Base budgets for the Division are too low ($200K O&M, $60K capital) requiring a significant amount of resources and energy to be spent on seeking ways to make up the shortfalls. The Division typically expends $700-$800K O&M annually.

(c) A complete overhaul and reconstruction of the H/H lab facility was planned and the design and implementation process begun with DPW. Consultant studies and pre-construction design plans were completed. Construction began in January

and is expected to be completed by July. Estimated costs for this major facility upgrading project are $800K.

753 (a) Annual activity report was completed.

(b) Work-plans were developed for the Division.

(c) Input was provided to communication plans, conference plans, the bridge funding exercise, Green Plan studies, national lab review, laboratory audit exercise, and many other similar externally-requested and controlled administrative programs and reviews.

(d) Comments, advice and Divisional position and perspective were provided to a number of queries to the lab.

754 (a) A comprehensive "Lab Safety Check-List" was developed and audit inspections of the laboratories were completed. Summary and detailed reports were prepared.

(b) Mandatory training program in lab safety procedures were put in place for all new staff (contractors, students, etc) in the Division.

(c) R. Thomas continued as Divisional representative on the RRETC Health and Safety Committee.

(d) WHMIS labelling and other requirements were completed on the majority of the chemicals housed in the various laboratories. This remains an ongoing activity.

(e) All fumehoods were calibrated for face velocity. An inspection program has been developed to ensure that fumehoods are safely used and properly maintained.

(f) Routine analysis of all solvents wastes before disposal and storage on site of PCB and PCDD/F-suspected solid wastes continues.

(g) Ron Halman continued his part time duties (20% of his time) as chemical waste coordinator for the Centre. As such, he served as a source of technical and analytical expertise on all matters relating to waste generation, documentation, storage and disposal for all divisions in the Centre.

755 A number of draft reports on the FPACAQ QA program in Chemistry Division have been prepared and reviewed by the RRETC Director and the Chief, Chemistry Division. A final report incorporating changes and directives provided by management remains to be completed.

756 Annual C&P Lab Managers Committee meetings in June and December were attended. Information on Chemistry Division's operation status, especially the QA/QC activities and the Hi-Res MS

capability, was presented to the Committee. At the request of the Committee, a strategy report and a contract specification for the Development of Operational Strategies for an Approach to Treasury Board were prepared and submitted.

757 Comments were provided to CGSB on a proposed method for the determination of aromatic hydrocarbon types in petroleum products.

Emergencies Science Division

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Services 3400-67550

Project Manager: M. Fingas (998-9622)

Objectives

Provide specialist technical advice and assistance on request; promulgate research and development results effectively; identify departmental and national technology development needs pertaining to spill countermeasures and establish priorities; and plan work and manage resources effectively.

Relevance

Supports the departmental and national capability to minimize the adverse effects of spills and similar environmental emergencies. Relates to priority issues to the extent that the event involves a toxic substance, a geographical area, resource, or similar focus of attention.

Work Plan

Services to clients by responding to requests for advice, comments, information, and on-site assistance; planning and progress reporting; management committee and technical working group meetings; technical workshops and seminars; serving on the program committee for the International Oil Spill Conference; and the ASTM Oil and Hazardous Materials Committee; reporting study results by various means including the Spill Countermeasures Technology Newsletter and Spill Technology Fact Sheets.

Status Report - March 31, 1992

a) Provided advice and/or lab support concerning the following emergency incidents:

- **August 23 - Hydrofluorosilicic acid spill, Edmonton;**
- **August 15-20 - Spill of water treating chemicals in Vancouver;**
- **August 8, 9 - pesticide fire , Harrow, Ontario;**
- **August 29 - Oil identification problem - Montreal;**
- **September 10 - CANUSPAC exercise, Vancouver;**
- **October 10-25, Nov. 2-4 - Rio Orcono Incident, Anticosti;**

- October 25 - Diesel Fuel Spill, James Bay;
- December 7 - Sulphur Trioxide Incident, San Salvador;
- December 13, 15 - Bunker C leakage from Irving Whale, P.E.I.;
- January 11 - May 8, Burning of Gulf Crude Oil;
- January 25 - March 31, Gulf Oil Spill;
- March 13 - Use of Lorcon Foam on Fire, Nova Scotia.

b) Provided on-site advice or specialized hazard-level monitoring assistance at the following incidents:

- St. Anne-des-Plaines tire fire
- St. Amable tire fire
- Gulf oil spill, Bahrain and Qatar
- AMOCO spill - Rock Mountain House, Alberta

c) Co-ordinated the development of eight joint-project agreements with the U.S. Minerals Management Service (US MMS) through which $425,000 (U.S.) were transferred to ESD, and the American Petroleum Institute agreed to transfer an additional $370,000.

d) Four papers were presented at the 1991 Oil Spill Conference.

e) The 13th AMOP Seminar (June 6-8) and the 7th Technical Seminar on Chemical Spills (June 4-5) were held in Edmonton.

f) The manuscripts for 5 EE-Series Reports, the Proceedings of the AMOP and TSOCS Seminars, and volumes 15(2), 15(3), and 15(4) of the Spill Technology Newsletter were forwarded for printing.

g) M. Fingas was a keynote speaker at a workshop convened by the U.S. National Academy of Science to determine research needs for oil spill response and to summarize progress to date.

h) M. Fingas participated in the ASTM F-20 Committee meeting in Niagara-on-the-Lake on October 10-12 and another in Orlando on February 20-11.

i) M. Fingas was invited to make a presentation on oil spill biodegration for a U.S. Congress review of oil spills. A written submission was given.

j) M. Fingas attended and participated in a test of chemical spill dispersion at sea. The tests were held offshore France and were funded by NATO/CCMS. Several presentations on these tests were given.

k) **Tasks and priorities for FY 91/92 were established following meetings of technical working groups chaired by ESD and consultations with clients and collaborators.**

Fate, Effects and Assessment of Spills 3400-67499

Project Manager: G. Sergy (403-468-8039)

Objective

Determine the environmental effects (and fate) of substances spilled or likely to be spilled; develop and evaluate spill response countermeasures and decision tools using environmental criteria.

Relevance

Supports the departmental and national capability to minimize the adverse effects of spills and similar environmental emergencies. Relates to priority issues to the extent that the event involves a toxic substance, geographical area, resource of similar focus of attention.

Work Plan

1. *SCAT Manual: Produce a Shoreline Cleanup Advisory Team manual for coastal oil spills in the Pacific Northwest, by adapting the EXXON VALDEZ SCAT process, NESTUCCA experience, etc.*
2. *Shoreline Cleanup Training: Develop course content and arrange training on oiled shoreline cleanup assessment (coastal processes/features, oil/shoreline interactions, cleanup techniques, priority setting, etc.)*
3. *Beach Cleaning Rates: Improve the capability to predict oil fate and reliably estimate natural self-cleaning rates of coarse sediment beaches*
4. *Monitoring in Prince William Sound: Support the emergence and continuation of sound long-term monitoring of stranded oil fate in PWS. Gain early access to data for interpretation in context of Canadian shorelines.*
5. *Pacific Coast Oil Spill Project: Continue phased development of an experimental oil spill program to evaluate shoreline cleanup techniques and effects.*

6. BIOS: Publish summary of 9 years observations on beached oil fate on an arctic shoreline.

7. Rotary Kiln: Modify the reciprocating kiln incinerator design to expand versatility and improve efficiency for burning of oily gravel. Construct and test modified version.

8. Oiled-Cobble Washing System: Design, construct and test a portable 'remove and wash' technique for restoration of oil contaminated cobble.

9. Effects Book: Rewrite English text copy to publication-ready stage.

10. Spill Treating Agents: Test chemical dispersants according to EP guideline protocols, in order to determine compliance to prescribed Environment Canada criteria. Test other spill treating agents to support guideline development and assess hazard.

11. Spill Substance Testing: Obtain and assemble toxicity data on selected oils and chemicals spilled or on spill substance priority list, to support spill manual update, assess hazard, establish response priorities, etc.

Status Report - March 31, 1991

1. **Manual drafted for BC, which will also serve as template for other geographic areas. External review planned before publication.**

2. **Course scheduled for Sept. 91. Content based on SCAT manual (above).**

3. **Evaluated existing data sets; assessed current models for estimating fate and persistence; proposed a conceptual mechanism for the same purpose. Report completed. In 1991/2 the project will compile available data sets (NOAA/Exxon/ADEC) into a consistent database; extracted data to the fit the model requirements and tested relationships of the model.**

4. **Under data access limitations, assessed various monitoring programs of 1989/90. Identified the 'best' existing data sets ie: those of merit to Environment Canada needs and determined that the monitoring of the best data sets were planned to continue in 1990 and 1991**

5. **Prepared and printed PCOS Concept report which addressed rationale and concerns. Held workshop of experts, completed and printed report outlining preliminary experimental design. Held meetings with C&P Pacific and BCMOE to develop support.**

6. **Summary report completed but not published.**

7. Design and construction of kiln completed. Unable to procure site/approval for testing because of lack of precedence.

8. Unit designed, constructed and tested as planned. Report completed.

9. No work because of overextended PY.

10. Completed testing on 30 products including dispersants, surfactants, bilge cleaners, solidifiers, surface cleaners, bioremediation agents.

11. Conducted toxicity testing on 15 different crude oil / refined oil products.

Additional Unplanned

12. Gulf War Oil Spill: Served on the Canadian Assessment Team. Assessed the oil spill preparedness and response capabilities of Bahrain and Qatar in regards to protection and cleanup of their resources and facilities; determined what was needed from Canada in terms of equipment, material and expertise; determined what other nations were contributing and the framework for international cooperation.

13. Bahrain/Qatar Survey: Surveyed coastlines of Bahrain and Qatar; documented the bio-physical characteristics; and recommended shoreline protection and cleanup guidelines appropriate to the various types of shorelines. Report completed and printed.

14. Beach Cleanup Evaluations: Reviewed existing literature, documented experiences and studies to assess the value and status of quantitative information on the effectiveness and effects of different techniques for coarse sediment shorelines. Study required to support PCOS project rationale. Report completed and printed.

15. Toxicity Test Methods: Initiated program to develop procedural variations for preparation and aquatic toxicity testing of problematic spill substances (eg. low solubility, volatile, solids etc). Such methods do not exist in the world, yet are required for standardized testing of spill-treating agents, and development of guidelines thereon, and the comparative evaluation of spill substances.

Fate, Behaviour and Analysis 4100-67599

Project Manager: M. Fingas (998-9622)

Objective

To determine the cold-climate properties and behaviour of spilled substances and the effectiveness of spill-treating agents.

Relevance

Supports the departmental and national capability to minimize the adverse effects of spills and similar environmental emergencies. Relates to priority issues to the extent that the event involves a toxic substance, geographical area, resource, or similar focus of attention.

Work Plans

550 Maintain spill-response equipment in readiness for emergency deployment and keep laboratory facilities ready to provide support.

551 Attend as an observer at the large French chemical fate and behaviour offshore experiment.

553 Continue development of portable (Level 2) field analytical methods for organic substances in soil and water.

554 Continue work in-house on dispersant formulation improvements and effectiveness test methods.

555 To develop a new fluorosensor for oil detecting in water and oil on water.

556 Continue to expand the library of identifiable substances in the Level 3 mobile field analytical system and demonstrate its capability.

557 Deliver the completed manuscript for the PCB EnviroTIPS manual.

558 Produce a preliminary draft of guidelines for the use of oil spill treating agents including oil dispersants.

559 Participate in a joint project with U.S. Minerals Management Service to study oil burning as a spill countermeasure.

560 *Give one training course on the use of field analytical equipment and the associated personal protection equipment; and continue the scheduled replacement of worn-out personal protection equipment.*

561 *Deliver the completed manuscript for the basic manual "An Introduction to Hazardous Materials Spills".*

562 *Continue work on the production of an expanded Manual for Spills of Hazardous Materials including another section containing less comprehensive information on at least 5,000 additional substances.*

563 *Study oil photooxidation - a joint project with U.S. Minerals Management Service and the American Petroleum Institute.*

566 *Participate in a joint study with Department of Fisheries and Oceans to develop a new oxygen meter.*

567 *Continue the joint project with the US MMS to acquire an understanding of how water-in-oil emulsification occurs.*

568 *Partially fund and oversee a multi-year study by the U. of Calgary (Prof. R. Rowe) to determine the effect of subsea blowout orifice size on oil droplet size.*

569 *Develop an oil thickness sensor. Joint project with U.S. Minerals Management Service, American Petroleum Institute and Esso Resources.*

570 *Test selected new analytical devices that appear to have potential for field use in spill situations.*

571 *Review and extend previous work on the behaviour of spilled oil under first-year ice. (Year 1 of a 2-year extension of a NOGAP project).*

572 *Continue to serve as an invited member of the review committee for the project to update the USCG HACS and NOAA CAMEO.*

573 *Improve the modelling capability for soil penetration by spilled substances by partially supporting ongoing work at the U. of Waterloo or by undertaking a review of what has been learned.*

574 *Continue to investigate the fate and behaviour of heavy and submerged/overwashed oils at laboratory scale as a continuation of the FY90/91 joint project with the US MMS.*

575 *Analyse old remote sensing data to determine the relationships of slick properties and IR returns.*

Status Report - March 31, 1991

550 a) The towed fluorometer was upgraded. Fluorometers were loaned to France for 2 series of experiments.

b) Several sampling and test kits were prepared.

551 Major chemical spill dispersion experiment in France was attended and several presentations of results were made.

553 Contract awarded to Counterspil Research Inc. A re-test of over 70 methods for quantifying spilled compounds in soil and water was completed.

554 Work was done in-house using contract personnel. Two papers on this work were presented at the 1991 Oil Spill Conference. A paper describing the results was presented at the AMOP seminar. This study was cooperative with the U.S. Minerals Management Service.

555 This is a joint program with PERD, Fisheries and U.S. Minerals Management Service and the American Petroleum Institute. A contract was let to Barringer Research who had originally submitted an unsolicited proposal. A Prototype unit was completed and bench-tested.

556 Contract was awarded to Mobile Vehicle System Inc. A new GC-MSD and supercritical fluid extractor was installed in the van.

557 A number of important deficiencies were identified during the response to the St. Basile-le-Grand incident and revisions will be delayed pending the availability of external funding. Work began in-house to finish the PCB manual.

558 Guideline needs have been tabulated. A test for surface washing agents, solidification and dispersing has been developed, and performance data have been obtained for over 100 such agents. A draft outline of the guideline was produced.

559 A contract was let to D.F. Dickins Associates Ltd. and one to Fraser Consultants to begin planning for the major burn experiments. Samples from test burns were analyzed by ESD on preliminary runs.

560 A first draft of the safety equipment catalogue was reviewed. In the continued absence of requirements set by any other departmental or national authority, ESD prescribed its own training requirements for staff issued with personal protection equipment by ESD. Two sets of courses were given to a total of about 40 people.

561 Unsatisfactory chapters of the first draft of the manuscript must be rewritten. Task deferred to next year because of lack of funds.

562 Data collection contracted to Consultchem. Data collection for all of the 5,000 compounds was completed.

563 Contract was awarded to Consultchem. A report was completed and will be presented at next year's AMOP seminar.

566 Deferred for lack of resources. DFO also deferred project.

567 Contract awarded to Consultchem near the end of the year. The experimental work will be done in-house using the unique ESD facilities.

568 Second year results were reported at the AMOP seminar. A third-year contract has been awarded and the work is in progress.

569 A prototype oil thickness sensor was assembled at IMRI in Boucherville, Quebec and successfully tested.

570 Five devices were tested and a draft report prepared.

571 Deferred pending receipt of NOGAP funding. NOGAP program is no longer active.

572 No meetings were convened during the reporting period, but several papers were reviewed.

573 Deferred for lack of resources.

574 Contracts were awarded to Consultchem and DMER respectively to determine the properties of specified heavy oils and to further investigate property changes in submerged/overwashed oils. The Consultchem data have been incorporated into the revised oil properties catalogue and a draft report has been received from DMER. The latter contract focussed on the evaluation of the long-term weathering of submerged oils.

575 A visiting professor, Dr. Fondekar, worked on the old remote sensing data analysis. A contract was let to Innotech for further analysis.

Emergencies Engineering Division

Emergencies Engineering Division 3400-67500

Project Manager: H. Whittaker (991-1842)

Objectives

To develop, evaluate and demonstrate technologies for the treatment of oil and chemical spills and chemical landfill leachate.

Relevance

Supports the departmental objective of environmental protection by ameliorating the effects of spills and leachates.

Work Plans

500 Engineering Overhead. Provide advice, comment, information and on-site assistance for oil and chemical spill situations. To attend conferences and committee meetings in order to remain aware of advancements in the area of spill remediation and inform persons, working in this area, of EED's work and findings.

501 Oil and Hazardous Materials Simulated Environment Test Tank (OHMSETT) Refurbishment. Under the agreed joint project agreement with the U.S. Minerals Management Service (U.S. MMS), participate in test protocol development and skimmer testing in the re-activated OHMSETT facility, contributing at least $25K towards the cost of that work.

502 Modified Kiln. Provide engineering assistance to Western and Northern Region (WNRO) for the redesign, construction and testing of the reciprocating kiln incinerator for cleaning oily beach materials. (Partial funding from the Panel on Energy Research and Development (PERD))

503 Cobble Washer. Provide engineering assistance to the WNRO for the design, construction and testing of a field deployable "remove and wash" technique for restoration of oiled cobble. (Partial PERD funding)

504 Process Train Development. Evaluate various aspects of the EED's process train for the removal and destruction of contaminants from water.

505 Acoustic Devices. Design and test quartz plate transducers for moving and atomizing oil.

506 Skimmer Catalogue. Compile an up-dated catalogue of the world's production of oil skimmers in cooperation with the Canadian Petroleum Products Institute (CPPI).

507 Boom Catalogue. Compile an up-dated catalogue of the world's production of oil spill booms in cooperation with CPPI.

508 Containment Study. Set-up and co-ordinate a workshop to re-think the containment of floating oil from first principles.

509 Freeze Crystallization. Investigate freeze crystallization as a means of removing concentrated inorganic contaminants from water.

510 Membrane Evaluation. Evaluate selected new commercial RO membranes under controlled laboratory conditions.

511 Soil Cleanup. Carry out a literature search into existing solvent extraction technology for oil and pentachlorophenol contaminated soils. Carry out laboratory and small scale pilot plant testing of a process involving the use of gas field condensates for solvent extraction of those soils. (Partial funding from the Groundwater and Soil Remediation Program (GASReP))

512 Water Jet Barrier. Under a joint project agreement with the US MMS, redesign, modify and test the flotation system for the water jet barrier.

513 Steam versus Air Stripping. Compare steam stripping and rotary air stripping for the removal of volatile and semi-volatile contaminants from water.

514 Sorbent Evaluation. Test sorbent products in-house on a continuing and as-required basis under the agreement with the Canadian General Standards Board.

515 Filtration Comparison. Compare bubble aeration/direct filtration to microfiltration for the removal of suspended solids from water.

516 Boom Test Protocol. Complete and finalize the draft boom test protocol in accordance with the joint project agreement with US MMS.

517 Photocatalytic Evaluation. valuate three competing photocatalytic processes for the destruction of organic molecules in water.

Status Report - March 31, 1991

500 The division chief was a member of a Canadian assessment team which was sent to Bahrain and Qatar to assist in the Persian Gulf oil spill. Divisional staff provided information on oil spill response products to Canadian Coast Guard and External Affairs and responded to proposals and queries from many inventors and contractors.

Harry Whittaker chaired 2 meetings of the ASTM Committee F-20 on oil and chemical spill response. Lisa Keller attended both meetings and is leading the sub- committee involved in setting new guidelines for the use of membranes in spill cleanup and a new test protocol for sorbents.

Lisa Keller attended one Pump and Treat Sub-Committee meeting as part of the Groundwater and Soil Remediation Program.

Monique Punt attended three Excavate and Treat Sub-Committee meetings as part of the Groundwater and Soil Remediation Program and replaced Lisa Keller at one Pump and Treat Sub-Committee meeting.

Monique Punt attended two Prairie Regional Oil Spill Containment and Recovery Advisory Committee meetings in Calgary.

501 EED's contribution was transferred to U.S. MMS.

502 The re-designed kiln has been built. Testing, which was planned for the fall of 1990, was prevented by delays in receiving approval from Ontario Ministry of the Environment. It is now scheduled for October 1991, at Chebucto Head, N.S., in a joint project with Canadian Coast Guard.

503 The Cobble Washer has been built and tested. Results were very encouraging. This technology, with some amendments, can probably be used for oil and some chemical spills in gravel and cobble. A paper was prepared for the 1991 Arctic and Marine Oil Spill Program Technical Seminar.

504 Gloucester trial - Several process elements of the process train (reverse osmosis, microfiltration, enhanced oxidation and steam stripping) were field tested at the Gloucester Landfill. A very successful test was carried out. The efficiency of steam stripping and enhanced oxidation for situations such as Gloucester were proven. Air stripping was added to the technologies tested. As a result of EED's testing, enhanced oxidation was selected for long term remediation at Gloucester.

Enhanced oxidation of pesticide residues was investigated in a joint project with Agriculture Canada. A bench-scale study was carried out and a report summarizing that and other available technologies produced. It was demonstrated that enhanced oxidation could destroy the pesticides but further work to investigate intermediate products formed is required.

Industry Projects - The following joint projects were carried out with industry.

- Testing of enhanced oxidation of propellant and explosive contaminated wastewaters at the US Naval Station at Indian

Head Maryland in conjunction with Solarchem Environmental Systems.

> *Results:* Inlet concentrations of 4 explosives in the 110 to 4630 ppm range were all reduced to below 1 ppm.

- Testing of reverse osmosis and enhanced oxidation on wood preservative contaminated water in conjunction with Domtar Fine Papers.

  > *Results:* Ultrafiltration (UF), reverse osmosis (RO) and enhanced oxidation (EO) were used. The destructions efficiencies for phenol and pentachlorophenol (PCP) ranged from 99% to 99.9% and 92% to 99.6%, respectively. A further study of the destruction efficiency of the PCDD/PCDF's present in PCP solution as a function of the conditions used in the enhanced oxidation run (eg. pH, H2O2 concentration, UV light, ozone concentration) is planned for fiscal year 91/92.

- Determining the ability of enhanced oxidation to destroy ferricyanides and copper chelates in conjunction with Stablex Canada Inc.

  > *Results:* Complete analytical results are still lacking. It is, however, known that at least 66% destruction of complexed ferricyanides was achieved.

- Testing the combination of microfiltration and reverse osmosis (and offsite enhanced oxidation) on leachate from an Ontario landfill in conjunction with Gartner-Lee Limited.

  > *Results:* Very good results were reported. A report is expected shortly from Gartner-Lee.

- Participation in competitive testing of the Canadian RAYOX process and 2 similar U.S. processes (including Peroxidation Systems) for decontamination of a U.S. Superfund site in North Muskegan, Michigan by U.S. EPA, in a joint project with Solarchem.

  > *Results:* Data have not yet been received.

- Demonstration of the mobile RAYOX enhanced oxidation unit at a Superfund site in Woburne, Massachusetts in a joint project with Solarchem Environmental Systems.

  > *Results:* Industrial, high strength waste stream containing high iron concentrations and VOC's in the 10 - 12,500 ppb were range reduced to less than 5 ppb.

505 Project delayed through lack of resources. A new acoustic barrier will be evaluated as part of a barrier evaluation planned for FEY 91/92.

506 A new edition of the "World Catalogue of Oil Spill Response Products" was produced in cooperation with U.S. MMS & USCG.

507 A new edition of the "World Catalogue of Oil Spill Response Products" was produced in cooperation with U.S. MMS & USCG.

508 Delayed through lack of resources. A workshop is planned for FEY 91/92 in cooperation with U.S. Coast Guard (USCG), U.S. Marine Spill Response Corporation (U.S. MSRC) and the Priarie Region Oil Spill Containment and Recovery Advisory Committee (PROSCARAC).

509 Project delayed as a result of lack of resources.

510 A bench scale RO unit was purchased. This unit will allow for more economical membrane testing. Several commercial membranes were selected for testing and most were received.

511 A survey of countermeasures for contaminated soils was carried out and a publication produced in conjunction with GASReP. Laboratory scale evaluations of natural gas liquids and hexane for solvent extraction of oil from various soils were carried out. Very good results were achieved. Small pilot plant testing has been held up by delays in modifications to the explosion proof test building.

512 The water jet barrier has been completely redesigned by Fleet Technology. Construction of a new prototype is largely complete. Stability testing without oil, in a joint project with the Canadian Coast Guard, is planned for August at Prescott. Testing with oil in the OHMSETT facility is planned for October, if the stability testing is successful.

513 Steam stripping and a new type of air stripping were compared during testing at the groundwater treatment test at the Gloucester Landfill. A paper was prepared for the 1991 Technical Seminar on Chemical Spills.

514 Progress was made on a new series of sorbent test protocols in discussions with Canadian General Standards Board (CGSB) and the American Society for Testing and Materials (ASTM). The long term objective is to have a common North American test protocol. Several sorbents were received for testing, expected to commence in the Fall of 1991, under the latest version of the protocol for sorbents for use in recovery of oil from the water surface. U.S. MMS, USCG, the Canadian Coast Guard (CCG) and MSRC have now joined this program. Test methods will eventually be developed for industrial hydrocarbon and chemical spill sorbents as well as marine oil spill products.

515 A study evaluating various techniques for removal of suspended solids and inorganic contaminants was commenced under the direction of an NSERC Fellow from the Mendelev Institute in Moscow. This work will continue into fiscal year 1991/1992. Concurrently, a GASReP project at the University of Waterloo is

examining diffused aeration with and without Ferric Hydroxide bearing recycle stream, chemical oxidation to complement the removal of Manganese in its solid state and direct contact sand filtration.

516 The draft protocol has been completed and is under review in EED and U.S. MMS.

517 Delayed by lack of resources.

Pollution Measurement Division

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NAPS Network Operations 3200-67201

Project Manager: P. Brunet (991-9460)

Objective

Co-ordination of the NAPS network for the measurement of ambient air quality in major urban centres and other areas of concern in Canada.

Relevance

Information on fluctuating ambient air levels of contaminants is essential for the identification and assessment of air pollution problems as well as for the development and evaluation of the effectiveness of control strategies.

Work Plan

1. *Assist provincial agencies in the operation and maintenance of NAPS stations.*
2. *Procure, verify and distribute 25 replacement continuous analyzers.*
3. *Procure, verify and distribute 100 zero and span gas cylinders.*
4. *Process TSP and IP filters and COH tapes for sampling.*
5. *Maintain network equipment inventory and site documentation databases.*
6. *Plan and organize 2nd NAPS Operations Technical Meeting in Halifax, N.S.*
7. *Publish revised edition of the Site Documentation Manual.*
8. *Modify NAPS display data interface and exhibit display at A&WMA, Indoor Air conferences and Environment Week and in the NCA.*

Status Report - March 31, 1991

1. Technical assistance in the operation and maintenance of NAPS stations across Canada was provided to provincial and municipal network agencies in trouble-shooting ambient air analyzers, providing replacement parts, consumables and maintenance kits. Over 24 analyzers and calibrating equipment were repaired.
2. In support of the instrument replacement program, 12 CO, 4 ozone and 5 NO_x analyzers were provided to NAPS agencies. Two ozone

analyzers, 3 COH samplers and 7 recorders were overhauled and put back in service.

3. **In support of the NAPS network, the following transfer and calibration standards were certified and supplied to NAPS agencies: 76 NO span cylinders, 8 CO span cylinders, 3 NO and 8 CO calibration cylinders, 9 SO_2 permeation tubes. One span gas cylinder was calibrated for Transport Canada, 3 PAH samplers were calibrated for Norsk Hydro of Quebec, 8 Ozone analyzers were calibrated for the National Council of Canada, C&P Atlantic Region. One CO analyzer for the Ottawa station was calibrated.**
4. **In support of the measurement of total suspended particulate matter, lead, sulphates, nitrates over 2500 TSP filters were processed and supplied to NAPS agencies and to others for special studies. In support of the measurement of inhalable particulate matter over 1200 PM_{10} filters were processed and supplied for 15 NAPS stations. Analyzed results from the Chemistry Division were formatted for NAPS data publications.**
5. **The network equipment database was maintained and an updated inventory was sent to all agencies.**
6. **The second NAPS Operations Seminar held in Halifax was organized with the participation of the Ambient Section staff and representatives from all NAPS agencies.**
7. **Operation of the Wurtemburg station was transferred from Ontario MOE to Environment Canada. Data collection for the Hull station was transferred to Environment Quebec who are calibrating the station. A number of meetings with Ontario MOE were attended to discuss changes in the operation of the two Ottawa stations.**

NAPS Network Data Processing and Publications

3200-67202

Project Manager: P. Brunet (991-9460)

Objective

Process, validate, interpret and prepare summary reports on ambient air quality data in major urban centres and other areas of concern in Canada.

Relevance

Information on fluctuating ambient air levels of contaminants is essential for the identification and assessment of air pollution problems as well as for the development and evaluation of the effectiveness of control strategies.

Work Plan

1. *Compile, validate and publish 12 monthly data summaries.*
2. *Compile, validate and publish 1 annual data summary.*
3. *Compile, validate and publish special data reports - including inhalable particulates, SO_4, heavy metals.*
4. *Input all inhalable particulates, metal and organic data into the NAPS database.*

*5. *Prepare data reporting procedures for generating special data reports using new Model 204 data base.*

*6. *Incorporate data from non-NAPS ozone and NO_x stations.*

*7. *Extend on-line access of data base by users.*

**** Availability of external funds will determine scope of these projects***

Status Report - March 31, 1991

1. NAPS network air quality data were collected and processed for publication. Monthly NAPS reports from August 1989 to July 1990 have been validated and sent for publication. The 1988 annual NAPS report was published.
2. NAPS data tape and station information was prepared and sent to Dr. A. Lefohn, Montana. Requests for annual and monthly summaries were processed.
3. The 1989 NAPS annual data report with the addition of sulphate and nitrate data and the monthly summaries from January 1990 were generated from the NAPS M204 data base. Uploading and validating of monthly and annual NAPS data reports, extract and inquire procedures were completed and are functional. Documentation for the data base and the entry of dichotomous data are being performed under contract.
4. Air monitoring data from recorder charts for the Ottawa-Hull stations to February 1991 were digitized. Hull data are collected by the Quebec Ministry of Environment as of May 1990. The Ottawa Slater Street station data are collected by a Telog datalogger as of October 1990.
5. In support of the NO_x/VOC, Ozone control program, Ozone data from all monitoring agencies across Canada were requested for input in NAPS M204 database.

NAPS Quality Assurance Program 3200-67203

Project Manager: P. Brunet (991-9460)

Objective

Review, update and continue implementation of a comprehensive quality assurance program for the National Air Pollution Surveillance (NAPS) Network.

Relevance

Important and far-reaching decisions are based on air quality data. Data may be used to determine attainment of air quality standards, the feasibility of plant expansions or process changes, the necessity of air pollution control device installation, in directing the future growth of industrial areas, and could serve as evidence in courts of law. With current emphasis on legal action and social pressures to abate pollution, it is essential that air quality data accurately represent ambient air conditions.

Work Plan

1. *Prepare sections of the NAPS quality assurance manual.*
2. *Implement recommendations from 2nd NAPS Operations Technical Meeting.*
3. *Carry out acceptance testing on NAPS replacement analyzers.*
4. *Conduct inter-laboratory tests of selected gases.*

*5. *Conduct 5-15 station performance audits.*

*6. *Conduct a series of NAPS network review projects by province or region.*

**** Availability of external funds will determine scope of these projects***

Status Report - March 31, 1991

1. **In support of the instrument replacement program, 12 CO, 4 O_3, 5 NO_x analyzers were acceptance tested and sent to NAPS agencies. Two O_3 analyzers, 3 COH samplers and 7 recorders were calibrated and returned to operating agencies.**
2. **The third NAPS interlaboratory testing program was completed. The results were analyzed and a summary report was distributed to**

participating agencies. The results were discussed in the NAPS Seminar held in Halifax.

3. **Three stations (2 National Capital Region, 1 Halifax) were audited.**
4. **Quality assurance activities in the network were reviewed and discussed at the NAPS seminar in Halifax. Quality assurance activities procedures in the Greater Vancouver Regional District and Montreal Urban Community were reviewed in detail. A summary on data accuracy in the NAPS network was prepared.**
5. **Participated in the U.S. EPA interlaboratory testing program. Since the implementation of the Dangerous Goods Act, calibration orifices were tested only and no compressed gases were tested. The three ozone reference standards were correlated with NIST.**
6. **Following the past year's evaluation, the use of NO_2 permeation tube calibrators was determined to be beneficial for operation in the NAPS network. Technical specifications for the purchase of six units were prepared. An optical absorbtion spectrometer was setup in the laboratory for evaluating its future utilisation. The spectrometer's poor reliability, operating characteristics and prohibitive price prompted the decision not to purchase a unit.**

Air Toxics Ambient Monitoring 3200-67204

Project Manager: T. Dann (991-9459)

Objective

Planning and conducting air toxics monitoring surveys to provide the data required for assessment and control of the environmental impacts of toxic air contaminants.

Relevance

The assessment of the environmental significance of specific air pollutants, classes of pollutants or of source categories emitting pollutants requires a valid ambient air data base in order to assess population exposures to the contaminants of concern. The CEPA Priority Substances List, the assessment of the impact of the Detroit Incinerator on Canadian air quality and the NO_x/VOC control program are all examples of issues requiring ambient air monitoring information.

Work Plan

**1. Monitoring and data assessment support for Detroit incinerator toxics monitoring program.*

2. Assistance re monitoring to determine health effects of LRTAP pollutants. On-going.

3. Assistance re toxics/LRTAP pollutant measurement and data interpretation, as required (All regions). On-going.

4. Emergency type monitoring, as required.

**5. VOC monitoring (data collection) at 25 urban and rural locations. Vancouver (3); Montreal (2); Toronto (3); Hamilton, Sarnia, Windsor, Halifax, Walpole Island, Winnipeg, Ottawa, Edmonton, Calgary and up to 10 new sites.*

6. VOC monitoring to support AES Eulerian modeling project.

7. PAH monitoring at four sites (Toronto, Hamilton, Montreal, Arvida).

8. Data reports on all monitoring efforts; provision of database on air toxics.

**** Availability of external funds will determine scope of these projects.***

Status Report - March 31, 1991

1. a) In support of the C&P Ontario Region monitoring program for the Greater Detroit Resource Recovery Authority (GDRRA) incinerator, the Windsor University Avenue and Walpole Island monitoring stations were maintained and supported during 1990/91. A second Windsor site (College/Prince Street) was established in June 1990. All sites are measuring dioxins, furans, polycyclic aromatic hydrocarbons, PCB, chlorophenols, chlorobenzenes, volatile organic compounds, inhalable particulates and metallic elements. PMD support includes co-ordination of field monitoring, processing all field samples for delivery to Chemistry Division, provision of VOC analyses, handling and reduction of all data generated from the program and interpreting results.

   b) Data Report #4 was prepared which included all results for October 1988 to September 1989 and was released in June 1990. A data report covering the period November 1989 to November 1990 is in preparation; this report will also determine if the Detroit incinerator is having a significant impact on measured toxic pollutant concentrations.

   c) A number of meetings of the Detroit incinerator monitoring committee were attended. Reports prepared by the contractor for the GDRRA were reviewed and data exchanges were arranged.

d) An Environment Canada/United States Environmental Protection Agency (U.S. EPA) Interagency Agreement was negotiated in conjunction with the Ontario Region. The agreement will result in EPA carrying out chemical mass balance analyses of the Windsor/Walpole inhalable particulate and VOC data to assist in determining major emission sources. Other aspects of the agreement will result in an enhanced monitoring program which will include acid aerosols, elemental carbon and scanning electron microscope analyses of some particulate samples. In support of the agreement, data files were prepared and reformatted for EPA.

2. a) Data on sulphates and nitrates were incorporated into the NAPS data base. The 1989 NAPS Annual Report contained summary statistics for sulphate/nitrate.

b) Assistance was provided to Health and Welfare researchers examining health effects of acid aerosols in Ontario. Assistance and data were also provided to R. Delfino of McGill University.

c) A workshop on aerosol monitoring research needs was attended at Atmospheric Environment Service (AES) in Toronto.

3. a) Assistance was provided to the Wastewater Technology Centre, Burlington to carry out a survey of carbonyl emissions from industrial wastewater treatment plants.

b) Over a hundred requests for air toxics data from government and non-government agencies were filled. Data were provided for the toluene, xylene and benzene, styrene, chlorobenzenes arsenic, antimony, polycyclic aromatic hydrocarbon (PAH), cadmium, dichloromethane, tetrachloroethylene and trichloroethylene CEPA Priority Substances List (PSL) assessments. T. Dann served as a member of the toluene and xylenes CEPA-PSL working groups.

c) A summary report containing all available Canadian data on ambient air PAH measurements was compiled for the Quebec Region in support of the PAH assessment. An analysis of the relative toxicity of PAH samples from various sites was carried out and a report prepared for Quebec Region and Health and Welfare.

d) VOC samples were collected on Saturna Island, B.C. and analyzed at the request of AES Pacific Region.

e) VOC monitoring was carried out in the basement of a home in Toronto at the request of Agriculture Canada. The occupant had complained about fumes related to indoor use of copper napthenate.

f) VOC samples were analyzed for the Newfoundland Department of Environment in support of the Goose Bay PCB incineration project.

g) Assistance was provided to MSED staff related to the measurement of VOC in automobile tailpipe and evaporative emissions.

h) The section assisted in the CIRAC (York University) sponsored workshop on research needs for toxic substances. A presentation on C&P's toxics measurement program was delivered.

i) T. Dann served as the Canadian chair of the International Standards Committee (ISO) TC-146, SC3 (Ambient Air). An international ISO meeting was attended in Paris.

j) T. Dann served as a member of the CCME FPACAQ Subcommitteee on air quality objectives. A number of committee meetings were attended and air quality criteria documents for hydrogen fluoride and total reduced sulphur compounds were finalized.

k) Assistance was provided to Health & Welfare and External Affairs in evaluating air quality in cities with Canadian embassies or consulate offices.

4. Ambient air data analysis and data interpretation services were provided in support of the Department's response to the Ste. Amable tire fire and the Kuwaiti oil fires.

5. Ambient air sampling for volatile organic compounds (VOC) is being carried out at nineteen urban sites and one rural site across Canada. A total of 130 different VOC species in the alkane, alkene, aromatic, alkyl halide, chlorinated aromatic and carbonyl categories are being identified and quantified; these include toxics as well as photochemical oxidant precursors.

6. Over 150 samples collected at Dorset and Egbert, Ontario were analyzed for VOC in April/May 1990. PMD provided support to method development/standardization activities and assisted other groups making field VOC measurements. A number of meetings and workshops were attended.

7. In addition to the two Windsor sites and the one Walpole Island site, PAH measurements are being made at sites in Jonquière, Montreal, Toronto and Hamilton. Initial data summaries were distributed and a data report is in preparation.

8. An extensive PC-based air toxics data base has been established and is updated regularly as results flow in from the field measurement programs. Numerous programs have been developed to allow output of summary statistics and for data display. A complete listing of reports and presentations is available in *Appendix A*.

Evaluation and Development of Ambient Measurement Technology 3200-67205

Project Manager: T. Dann (991-9459)

Objective

Development and evaluation of new ambient air pollution measurement technology to support priority issues such as Toxics, LRTAP and NAPS network. Developed measurement technology will be phased into the NAPS network as required.

Relevance

Because of the ever increasing list of air contaminants of concern, it is vital that effort be expended on development of ambient air measurement methods and on keeping up with developments in the field of air pollution monitoring technology. Efforts to develop and evaluate measurement methods for fine particulates and organic air pollutants have been undertaken in recognition of their priority in the Toxics and LRTAP issues.

Work Plan

1. *Further develop and apply measurement technology for VOC (toxics and oxidant precursors) at urban and rural sites in Canada.*

*2. *Finalize ambient dioxin method.*

3. *Further development of sampling methods for incinerator related toxics (metals, PAH, Dioxin, VOC).*

4. *Provide a summary of metal concentrations at Canadian sites and identify major sources.*

*5. *Further develop and apply methodologies for characterizing VOC emissions (including benzene and formaldehyde) from vehicle exhaust co-operative project with MSED.*

*6. *Preparation of data assessment reports for O3, NOx, VOC to support NOx/VOC management plan.*

*7. *Initiate development of measurement methods for total exposure assessment of specific contaminants.*

* *Availability of external funds will determine scope of these projects*

Status Report - March 31, 1991

1. a) Multi-component VOC standards in ppt concentration ranges for instrument calibration were provided to a number of agencies.

   b) A number of improvements were made to the field VOC sampling sytems.

   c) PMD continues to participate in round robin studies with the U.S. EPA and ORTECH for formaldehyde analysis of standards and test samples.

   d) A new Hewlett-Packard MSD unit was purchased and configured for VOC analysis.

2. Work continued on the Canadian Council of Ministers of the Environment (CCME) sponsored co-operative R&D project on ambient dioxin sampling and analysis. Activities included an inter-lab comparison involving eighteen Canadian and United States laboratories and sampling and analytical method write-ups. The proceedings of the workshop held in 1989 are being finalized.

3. An intercomparison of Environment Canada and Environment Quebec sampling systems for PAH is being carried out. An intercomparison of Environment Canada and Ontario Ministry of the Environment PAH and dioxin/furan sampling and analytical protocols is underway.

4. A report summarizing PM_{10} and metal concentrations for Canadian urban monitoring sites for the period 1984-1990 is in preparation. The Environment Canada/EPA Interagency Agreement (*see project 67204*) will aid in determining sources of PM_{10} and metals in Canadian urban areas.

5. Advice and assistance on the sampling and analysis of VOC for the MSED test program was provided.

6. a) There was extensive involvement in the drafting of the final version of the NOx/VOC Management Plan for Canada including the preparation of the monitoring and data analysis chapters and appendices. Meetings related to the second round of the public consultation process were attended.

   b) A workgroup meeting in Geneva was attended in support of the negotiation of an international VOC protocol under the auspices of the UN-ECE. The meeting involved a reactivity weighting approach to calculating VOC emission reductions. Extensive analysis of Canadian ambient and source VOC data was carried out in preparation for the meeting.

   c) Numerous requests for information on ground level ozone and related issues were handled.

d) An analysis of trends in ozone concentrations in Ontario and Quebec was made and a paper was delivered at the AWMA annual conference in Pittsburgh.

e) A presentation was prepared for the CIRAC-sponsored National Oxidants Research Workshop. T. Dann assisted in the follow-up to this workshop as a member of the steering committee to develop a national oxidants research program.

f) Inputs were provided to various groups developing plans related to the Green Plan submission for VOC/NO_x.

7. No activity.

Source Measurement Technology Development 3300-67206

Project Manager: P.K. Leung (991-9456)

Objectives

1. *Develop and/or evaluate Reference Methods (RMs) in support of CEPA regulations and guidelines.*
2. *Revise/update existing emission measurement methods to reflect changes in the art in both equipment and knowledge.*
3. *Develop new emissions measurement methods in response to emerging priority issues (eg. volatile organic compounds and other priority substances).*
4. *Evaluate commercially available monitoring systems capable of measuring stack emissions on a real-time basis.*
5. *Participate actively in technology transfer exercises.*

Relevance

Reference Methods (RMs), which are incorporated into national emission regulations/guidelines, specify the emission measurement procedures to be used to determine compliance. Other measurement methods/systems provide emission data to regulatory agencies over and above that required for compliance monitoring.

Work Plan

1. *Participate in joint EC-industries task forces to update the following CEPA Reference Methods: (a) Asbestos (Mining and Milling Operations), and (b) Vinyl Chloride (Manufacturing).*

2. *Update and develop, as required, Reference Methods in support of the Federal Industrial Boilers Emission Control Regulations under CEPA Part IV and provide source measurement advice/guidance to the FIBEC Task Force.*

*3. *Evaluate an emissions measurement method to determine the releases of volatile organic compounds (VOCs) from industrial sources such as incinerators.*

*4. *Develop a source measurement technology to monitor organic emissions on a real-time basis.*

5. *Provide training to CEPA inspectors in areas related to emission measurement; host/participate in source emissions measurement workshops; write technical reports to transfer technology to a variety of users.*

6. *Projects initiated during the review period.*

** Scope of these projects determined by the availability of external funds*

Status Report - March 31, 1991

1. a) *Asbestos (Mining and Milling Operations)*

i) *Screening Method.* In co-operation with IPB and Quebec Region, PMD chaired a joint federal/provincial/industry technical working group to address the industry's request to modify an existing asbestos Reference Method (EPS 1-AP-75- 1). PMD provided the working group with a method comparison study proposal which formed the basis of a jointly funded field testing program. Tests were conducted at several asbestos operations in the province of Quebec. PMD performed QA/QC (including on-site witnessing), reviewed the test results, and submitted a summary report on the testing program. Technical assistance was provided to IPB in the drafting of the DG's response to the industry. PMD recommended the acceptance of Method {MS-3/A-2} as a Screening Method for the estimation of asbestos emissions from mining and milling operations.

ii) *Wet Milling Method.* At the request of IPB, P&Y Region, and Newfoundland District Office, PMD drafted Method DS-1 for the measurement of asbestos emissions from high temperature sources such as wet-milling driers. The document was circulated to IPB and the regions for comments.

b) *Vinyl Chloride (Manufacturing).* A joint federal/provincial/industry task force was formed to update the existing Reference Method (EPS 1-AP-77-1). PMD is revising the sampling section of the RM and developing a semi-continuous method for the measurement of VC emissions from intermittent sources. Meetings were held with IPB to discuss the application of manual and continuous measurement methods in the compliance and enforcement of CEPA Vinyl Chloride Regulations. Plans were made for PMD to assist IPB at two CEPA regulations workshops in Edmonton and Sarnia.

2. *FIBEC.* PMD continues to assist IPB in the promulgation of the CEPA Federal Industrial Boilers Emission Control regulations by providing technical advice to the FIBEC Task Force in matters pertaining to emission measurement, by developing and publishing Reference Method EPS 1/RM/15 in support of the regulations, and by reviewing the draft regulations to ensure its compatibility to the RM.

3. *Volatile Organic Sampling Train (VOST).* The method development project was on-hold due to a lack of external funds and the departure of a Section staff.

4. *Real-time Monitoring of Organic Emissions.* This project was redeployed under the vinyl chloride method development program.

5. a) *CEPA Inspectors Training.* Several regional CEPA inspectors responsible for the compliance and enforcement of emission regulations were field-trained on the basics of sampling and on-site witnessing. A poll of the C&P regional offices across the country showed a strong need and support for more training. Preparation for a more expanded and formal program is underway.

b) *Technology Transfer.* To support source-related projects initiated by other C&P responsibility centres, PMD continues to develop and update technology transfer documents, such as the Technical Assistance Bulletin (TAB) and stack testing witnessing forms. PMD staff continue to serve on the American Society for Mechanical Engineers (ASME) PTC-45 Committee to develop and standardize protocols for the testing of municipal wastes incinerators.

c) *Scientific & Technical Advice.* Over 100 requests for copies of Environment Canada's source measurement methods, for advice on emission testing, for interpretation of test results, and for solutions to specific source sampling problems were received from EP Regions, other C&P responsibility centres, federal and provincial departments, universities, consultants and industries.

6. *Projects Initiated during Review Period.*

   a) *Quality Assurance/Quality Control.* A draft manual detailing the application of QA/QC procedures to continuous emission monitoring was completed. Internal review of the document is underway.

   b) *Formalization of the Reference Method Process.* PMD initiated discussions with IPB, RAPIB, Legal Services, and other C&P responsibility centres on a process to formalize the co-ordination of regulation promulgation activities and method development work. The PMD proposal was supported by all and approved by senior management. The appointment of process co-ordinators is expected next FY.

   c) *Particulates and Lead from Secondary Lead Smelters.* In the absence of a formalized process, IPB, originator of the CEPA Secondary Lead Smelters Regulations, had agreed to distribute the final drafts of the Reference Methods for particulates (EPS 1/RM/8) and lead (EPS 1/RM/7) to the regions for review and comments. The publication of the documents was again postponed when Industry objected to the lack of consultation on the RMs during the promulgation of the CEPA Regulations by IPB. Meetings were held to address the problem.

   d) *Mercury from Chlor-Alkali Plants.* Reference Method EPS 1/RM/5 was published in support of the CEPA Mercury Cell Alkali-Plants Regulations. The document replaces the old method EPS 1-AP-76-1.

   e) *Carbon Monoxide.* Reference Method EPS 1/RM/4, originally developed for monitoring CO emissions from oil refineries, was published in support of the proposed CEPA Non-hazardous Solid Wastes Incinerators Regulations and the CCME Guidelines for Municipal Solid Wastes Incinerators.

   f) *Total Reduced Sulphur.* Reference Method EPS 1/RM/6 was developed in co-operation with the Pulp and Paper industry for the continuous monitoring of TRS emissions. Final editing of the document is underway.

   g) *Continuous Monitoring of Selected Flue Gases.* A Recommended Method for the continuous monitoring of SO_2, NO_x, CO, O_2, and CO_2 was drafted and circulated for internal review.

   h) *Total Hydrocarbons (Heated).* A Recommended Method for the continuous monitoring of THC (heated) was drafted and circulated for internal review.

   i) *Nitrogen Oxides.* Laboratory tests were carried out to evaluate a time-integrated NO_x sampling method. The proposed method may replace the existing Reference Method EPS 1-AP-77-3.

j) *Multi-Metals.* A discussion paper entitled "*Evaluation of Modified Particulate Trains for the Measurement of Selected Toxic Metals MSW Incinerators*" was drafted and circulated for internal review.

k) *Cyclonic Flow.* A document entitled "*A Method for Measuring Particulate Emissions from Stationary Sources with Cyclonic Flow Pattern - Alignment Method*", was drafted and forwarded to the Joint Environment Canada/BC MOE/Alberta Environment Technical Committee on Cyclonic Sampling for review.

l) *Moisture Calibration.* A document entitled "*Development of a Calibration Apparatus for a Continuous Water Vapour Emission Monitoring System Used during NITEP-3*" was drafted and reviewed. Meetings were held with the 3T Division to discuss the potential for intellectual property licensing. An Environmental Technology Opportunity (ETO) document was drafted and reviewed by Technology, Training and Transfer Division (3TD).

m) *Gas Sample Conditioning System.* An ETO was drafted and submitted to 3TD for review.

Source Emissions Evaluations 3300-67207

Project Manager: P.K. Leung (991-9456)

Objectives

1. *Participate in the planning and field implementation of source emissions evaluation programs (including compliance/enforcement actions) initiated by other C&P responsibility centres, provincial governments and the private sector.*
2. *Provide support to C&P responsibility centres engaged in monitoring compliance with CEPA emission standards/-regulations/guidelines (eg. under the National Compliance Verification Plan).*
3. *Measure emissions of selected air toxics from industrial sources in support of specific C&P responsibility centre programs or in response to the needs of emerging priority issues.*

Relevance

C&P is responsible for specifying regulations/guidelines limiting the emissions of specific substances. Often, it becomes necessary to measure emissions to (a) determine compliance and (b) assess emission impact and the effectiveness of control measures.

Work Plan

Conduct emissions measurement programs and provide technical advice and witnessing expertise/testimonies in the evaluation of industrial sources such as (selection to be made during FY as needs, priorities and resources are identified):

1. *PCB mobile Incinerators (eg. Federal PCB Clean-up Program at Goose Bay).*

*2. *Secondary lead smelters.*

*3. *Vinyl chloride manufacturing plants.*

*4. *Hospital Waste Incinerators (Biomedical Waste Incinerator Program).*

*5. *Sydney Tar Ponds Incineration Program.*

6. *Other projects initiated during the review period.*

** Scope of these projects determined by the availability of external funds*

Status Report - March 31, 1991

1. *Federal PCB Clean-up Program at Goose Bay.* The final report on PMD's compliance testing was forwarded to the Wastes Management Branch, DND, Proctor & Redfern, and the Newfoundland District Office. External QA/QC/auditing of the consultant's work was also completed.

2. *Secondary Lead Smelters.* PMD was extensively involved with the Ontario Region (OR) in the implementation of Environment Canada's National Inspection Plan. Compliance testing at four Ontario operations (Tonolli, General Motors, Gates, and Canada Metals) were witnessed under the auspice of the CEPA Secondary Lead Smelters Regulations. PMD's input included:

   - Reviewing of test plans
   - Attending planning meetings
   - Performing pre-test QA/QC/auditing functions
   - Witnessing emission compliance tests
   - Analyzing, reviewing, and validating the compliance testing reports

3. *Vinyl Chloride Plants.* At the request of the Ontario Region, PMD witnessed the emission compliance tests at the Dow Chemicals plant in Sarnia.

4. *Hospital Waste Incinerators.* No request for technical assistance.

5. a) *SYSCO Phase II Modernization Program.* At the request of the Atlantic Region and Nova Scotia Department of the Environment, PMD reviewed SYSCO's project plan and final report on the compliance testing of the recently installed electric arc furnace baghouse. Planning for a second series of compliance tests has begun and PMD is providing source measurement expertise to the program participants.

   b) *Sydney Coal-tar Wastes Remedial Program.* PMD continued to provide technical support to the Atlantic Region and the provincial government in the evaluation of a fluidized-bed incineration system designed for the destruction of the coal-tar wastes. Technical advice on measurement methods and equipment were provided to the program participants. Criteria for the selection of a compliance testing consultant were also supplied to the program participants and RWDI, a sub-contractor of Acres International Limited, made the final selection. Preparation for external QA/QC, including on-site witnessing, is underway.

6. *Projects Initiated during Review Period.*

   a) *Incineration of Ship Wastes.* PMD was involved in a case against a barge incinerator burning ship wastes in the harbour of Vancouver. Technical support provided to the Pacific and Yukon Region and other C&P responsibility centres include:

      - reviewing the company's proposed compliance testing plan
      - examining and approving/rejecting the company's request to deviate from source testing protocols
      - redirecting the many political and non-technical issues raised by the company's president to the appropriate authorities
      - witnessing the compliance tests

   Note: PMD could not review the final testing report, the access to which was denied by the company's legal counsel.

   b) *Howe Sound Kraft Mill.* The objective of the P&Y Region project was to characterize the emissions from a modern kraft recovery boiler. The following represent PMD's major contributions:

      - advising on the sampling component of the contract terms of reference

- evaluating project proposals from the bidders and participating in the contract selection process
- reviewing and commenting on the test plan submitted by the successful consultant
- conducting pre-test QA/QC/audit on the consultant
- assessing the consultant's preparedness for the tests and recommending corrective actions for potential problem areas
- witnessing the tests
- completing a witnessing report

The quality of the consultant's work and data will be assessed upon receipt of the final testing report.

c) *CEPA Chlor-alkali Plants Regulations.* At the request of the Ontario region, PMD attended a planning meeting at ICI in Cornwall and witnessed the compliance tests for mercury emissions from the strong and weak hydrogen streams and the cell room vents.

d) *Cascades Ltée.* At the request of the Québec Region, technical support was provided to the St. Lawrence Centre project that is being carried out at Cascades Ltée. in Joliette, Québec. PMD assisted the Québec Region in the selection of suitable sampling methods and strategies to determine the efficiency of a regenerative incinerator that removes fumes from a tarring operation. PMD also attended an on-site meeting with representatives from DSS, the consultant, Québec Region, and the St. Lawrence Centre.

e) *Waste Oil Combustion.* A B.C. Research report describing the experiment to characterize emissions from the combustion of waste crankcase oil in residential furnaces in the Yellowknife-Hay River area was reviewed. Comments were forwarded to the Northwest Territories District Office.

f) *RRETC Low-NO$_x$ Boilers.* At the request of the RRETC Director, PMD attended weekly meetings with DSS and the boiler contractor to discuss acceptance testing of the newly installed low-NO$_x$ boilers. PMD calibrated the boiler manufacturer's analyzers and provided on-site technical advice on testing procedures. However, witnessing of the acceptance tests was not carried out due to boiler operational problems. Meanwhile, a PMD document proposing a long-term, three-phase testing program was completed and reviewed internally.

g) Technical information and advice related to CEPA compliance and enforcement testing were provided to other C&P responsibility centres, provincial agencies, consultants and industries.

Air Pollution Control Technology Development and Assessment 3300-67208

Project Manager: P.K. Leung (991-9456)

Objective

Co-operate with C&P responsibility centres and outside organizations in the assessment of air pollution control technologies through comprehensive emissions and process monitoring, and interpretation of results.

Relevance

C&P is required to identify and assess various control technologies that may be used to prevent or reduce the releases of pollutants to the environment. Technical advice on control options is required for the development of regulations and codes of good practice.

Work Plan

1. *Provide technical support (including program planning, QA/QC, on-site witnessing, and interpretation of data) to a joint multi-party program to evaluate the Vesta Mobile PCB Incinerator at Swan Hills.*

*2. *Characterize emissions and evaluate NO_x reduction technologies at selected federal boiler plants and participate in the assessment of control technologies with other FIBEC Task Force members.*

3. *Review and evaluate consultants' work on the emission characterization and performance evaluation of the refuse-derived fuel (RDF) incinerator in Connecticut, USA (joint EC-EPA NITEP III Program).*

*4. *Provide emissions measurement support to evaluate incinerator ash vitrification processes and associated control technologies (a proposed joint EC-US DOE-ASME program).*

*5. *Provide technical support to evaluate the fluidized bed technology for the incineration of municipal solid wastes (MSW).*

6. *Other projects initiated during the review period.*

** Scope of these projects determined by the availability of external funds*

Status Report - March 31, 1991

1. *Multi-Party Mobile PCB Incinerator Demonstration Project (vesta at Swan Hills).* PMD continued to provide technical support to the Waste Management Branch and other participants of the project. Phase II testing resumed after the regulatory agencies were satisfied with the remedial/corrective actions taken by the parties concerned to prevent release accidents. Representatives from PMD and the province of Québec assisted Concord Environmental, the External QA consultant, to complete the witnessing of the remaining tests. As Scientific Authority, PMD reviewed and commented on Concord Environmental's draft external QA report.

2. *FIBEC Program.* PMD continued to participate as a task force member of IPB's Federal Industrial Boiler Emission Control (FIBEC) program. Major contributions are as follow:

   a) *Promulgation of CEPA Regulations.* Reference Method EPS 1/RM/15 was developed and published as part of the CEPA FIBEC Regulations currently under promulgation.

   b) *NO_x Reduction Technologies Study.* A proposed follow-up study similar to the one conducted at AES was not realized due to a lack of funds.

   c) *DND Program.* Preparation work for testing the boilers at CFBs Halifax and St. Hubert was halted after DND had decided to "partner" with EMR instead of Environment Canada. At the request of EMR, PMD gave two visiting CANMET staff a tour of the RRETC source testing facilities and briefed them on PMD's experience with federal boilers tested in Ottawa and other cities.

3. *NITEP III.* There has been no further request for technical assistance. PMD has fulfilled all its obligations and commitments.

4. *MSW Incinerator Ash Vitrification Program.* PMD participated in a multi-party USA-Canada program to evaluate whether vitrification is a feasible technology for the pre-treatment of MSW incinerator ash prior to its disposal at landfills. PMD's major outputs include:

   - attending planning meetings in Oregon and New Jersey
   - providing source measurement expertise to other program participants and commenting on the overall design of the test plan
   - drafting a Request for Proposal (RFP) document for the emission testing portion of the program
   - compiling a list of stack testing consultants and evaluating their capabilities
   - evaluating bids

The RFP is currently being modified to reflect recent priority changes made by the steering committee. Testing is planned for next FY.

5. *Fluidized Bed Combustion Technology.* There was no request for technical assistance.

6. *Projects Initiated during Review Period.*

   a) *Shoreline Incinerator.* At the request of EED, PMD prepared for the testing of the protocol type incinerator designed to burn oil-contaminated beach materials. The project was postponed because of a permitting problem with Ontario MOE.

   b) Technical advice and information on PMD's experience with the evaluation of control technoldogies, such as PCB incineration and low-NO_x burners, were provided to both the public and private sectors.

Hazardous Waste Incineration Technology Development

3300-67209

Project Manager: P.K. Leung (991-9456)

Objectives

1. *Modify/upgrade both the STDS apparatus and laboratory to facilitate the study on dioxin formation in the heat recovery systems of municipal solid waste incinerators.*
2. *Participate actively in technology transfer exercises.*

Relevance

Data on thermal decomposition profiles, products of incomplete combustion and residuals are needed to support incineration as a viable control option. Laboratory studies are the first step in the generation of these supporting data.

Work Plan

1. *Evaluate STDS facility requirements; select and modify new STDS laboratory, if required; relocate equipment and re-install the STDS system, if required.*
*2. *Conduct further research on dioxin formation in the heat recovery systems of MSW incinerators.*
3. *Update the STDS operating manual.*
4. *Participate in the joint US EPA-EC Hazardous Waste Incineration Research Workshop.*

** Scope of these projects determined by the availability of external funds*

Status Report - March 31, 1991

The departure of a Section staff and a general lack of resources (funds and PYs) have hampered the progress of the STDS Program.

1. *STDS Facilities.* There is a general agreement that a new location for the equipment is required. Attempts were made to secure funding from the Green Plan and other sources, but without success thus far.

2. *Research on Dioxin Formation.* No external funds available.

3. *STDS Operating Manual.* Project completed.

4. *13th Hazardous Waste Incineration Research Workshop.* A PMD staff attended the joint Canada-USA workshop held in Dayton, Ohio.

Mobile Sources Emissions Division

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Quality Control / Assurance 3200-67810

Project Manager: J. Rostkowski (998-9590)

Objective

The MSED achieves and maintains an internationally recognized reputation for accuracy and precision in areas of compliance/regulatory vehicle testing, joint government/industry development projects and research and development in energy and emissions by conducting a wide range of quality control/quality assurance activities.

These activities include: the calibration, repair and maintenance of all the laboratory test instrumentation for light/heavy duty vehicles and field-use equipment, development and maintenance of computer controlled automation systems for all aspects of the test system (ie: dynamometers, analyzer benches, sampling systems and video display systems), the analysis of gas cylinders for primary reference, the evaluation of all test fuels, the development of specialized systems for sampling and analysis of organic and inorganic non-regulated emissions in the vehicle exhaust and the development of test and quality control procedures for project-specific test parameters (eg: H2 from electric vehicles during charging sequences, exhaust form recreational outboard motors).

Relevance

Environment Canada would have no credibility and thus no influence in mobile source emission matters without accurate test data from the project work undertaken. Decisions based on unverified test results would be questionable.

Work Plans

1. *In-house calibrations, repair and modifications totaling 90 working days per year for the five test cells.*
2. *Participate in: 6 gas cylinder concentration cross-correlation projects with government and industry, 4 gasoline analysis cross-correlation sponsored by the Alberta Research Council.*
3. *Participate in two alcohol/aldehyde sampling reference standards round robin cross-correlation programs with government (US EPA) and industry.*
4. *Conduct in-house audits and correlation testing on the non-regulated emissions sampling trains (dilution tunnel).*

5. *In-house calibrations, repair and modifications on the MSED organic analysis instrumentation (ie gas chromatographs, High Precision Liquid Chromatograph, VOC analysis instrumentation, sulfur compounds analysis equipment) with the technical expertise from Pollution Measurement Division.*

6. *Analyze 240 gaseous bottle concentrations and 20-40 fuel samples for RVP and specific gravity.*

7. *Conduct approximately 300 in-house repeat vehicle chassis dynamometer tests in both light and heavy duty test cells.*

Status Report - March 31, 1991

2. a) The MSED participated in the Scott Specialty Gas, Cross Reference program. This consisted of the measurements of the contents of an unknown sample of THC, CO, CO2, NO, NO2 each quarter. A final report was prepared by the coordinator of the Scott program.

   b) The laboratory participated in the Alberta Research Council's round robin fuel analysis program. The MSED analyzed six samples of fuels, most representative of the laboratory's test fuels.

4. a) An Ottawa-Carleton Transit Bus was purchased and modified to serve as a test vehicle for quality assurance purposes for the heavy duty test system.

   b) A series of test projects were conducted to confirm the accuracy of non-regulated and regulated emission results. These included:

      i) Degradation of vehicle exhaust emissions over time while stored in tedlar bags.

      ii) Determination of the effect of a separate preconditioning cycle vs soaking immediately after a test sequence.

      iii) Determination of the differences between a weighted one bag UDDS sample for VOC versus a composite result from the analysis of all three phases.

   c) The MSED conducted reference checks and established a level of confidence in the operation of two new sampling systems for interior vehicle testing and marine vessel propulsion system measurements.

5. The calibration laboratory analyzed 350 gas bottles for concentration and impurities. In addition constant monitoring of the zero air was conducted due to the discovery of impurities.

   a) An analysis system was setup for the determination of soluble organic fractions from particulate filters from heavy duty diesel vehicle testing. A series of reference checks were conducted to verify the results.

   b) The dilution tunnel was modified to insulate and heat all of the sample transfer lines to minimize losses due to thermophoresis effects.

   c) The MSED organic analysis laboratory was completed during this year. The organic analysis instrumentation was relocated to this area and setup for operation. A series of reference standards and checks were conducted to ensure the level of accuracy.

   d) A project was initiated to prepare a report on the analysis methodologies employed for each different compound evaluated. This included the quality control checks and reference standards necessary to ensure accurate and complete analysis.

7. Total in-house quality assurance and cross-correlation vehicle testing activity is shown below:

EMISSION TESTS

UDDS (city cycle)	45
HWFCT (highway cycle)	20
Hot Start LA-4	300
Heavy Duty Vehicle Cycle	15
EVAP (evaporative emissions)	15

8. The MSED served as a reference point for the analysis of the contents of gas cylinders for the Transport Canada, Motor Vehicle Test Centre. In addition, the MSED provided verification analysis results to Matheson, the manufacturer of the contents of gaseous cylinders.

Vehicle Cross-Correlation Programs 3200-67815

Project Manager: J. Rostkowski (998-9590)

Objective

To establish a level of credibility for all vehicle test projects the facility participates in a series of government (US EPA) motor vehicle manufacturer test vehicle cross-correlation programs. These include a maximum of four with the North American MVMA (Motor Vehicle Manufacturers Association), Japanese Automotive Manufacturers Association (JAMA) and special audit programs with the US EPA.

The MSED also coordinates programs with the individual automotive manufacturers, specifically GM, Ford and Chrysler for the correlation of specific test parameters and for research and development purposes, including heavy duty vehicles.

In Canada the facility supports the automotive industry and other laboratories (both government and private) by providing a vehicle test reference point.

Relevance

The MSED establishes the accuracy and level of confidence in the testing system (both instrumentation and procedural operation) through vehicle test cross-correlation with the automotive manufacturing industry and the US EPA. The results of such programs verify the level of accuracy established through the Quality Assurance/Control activities.

Without the confirmation established through such programs, Environment Canada and the government would have no credibility with respect to the new model year compliance testing and the development of regulations and guidelines for mobile source emissions based on the MSED testing.

Work Plans

1. *Five light duty passenger car testing cross-correlation projects per year of one week each with MVMA, JAMA.*
2. *Two light duty diesel vehicle testing cross-correlation projects per year of one week each with industry.*

3. *One or two (depending upon availability and associated costs) heavy duty vehicle test cross-correlation projects with industry, ie: South West Research or EPA-Research Triangle Park.*

4. *Conduct approximately 50 vehicle dynamometer tests as a participant in inter-laboratory vehicle chassis dynamometer cross-correlation programs.*

Status Report - March 31, 1991

1. a) Three manufacturer's vehicle cross correlations were conducted during the year. These were as follows:

   The MSED organized and coordinated a vehicle test project with the General Motors certification test cell at the Michigan-GM Proving Grounds. A vehicle was prepared, tested and shipped by the laboratory to General Motors for testing.

   The results of the project indicated excellent correlation for both regulated exhaust emissions and fuel consumption.

   b) CAMI (Suzuki/GM) in Ingersoll, Ontario coordinated a vehicle test project with the MSED using a 1990 Suzuki Swift manufactured at CAMI. The vehicle was tested at CAMI, shipped to the MSED for testing and returned to Ingersoll for confirmation cycles.

   c) A 1990 Plymouth Sundance was returned to the manufacturer in Chelsea, Michigan after having been identified as an investigation vehicle. The test results from the two laboratories were used for correlation purposes.

   d) A 1990 Ford Escort was transported to Ford Motors CO, Dearborn Michigan for retest as a result of noncompliance at the MSED laboratory. The results of the testing were compared for correlation purposes and indicated good correlation.

   The manufacturer's laboratory in Ingersoll then coordinated a similar program with their US laboratory in Michigan.

   A summary of the testing was prepared.

3. A 1982 ORION bus, part of an NRC research and development program (regenerative braking system) was tested on the heavy duty system at the MSED on a repeat basis. This unit was previously evaluated by the testing facility at the South West Research Institute, San Antonio Texas. A comparison of the data, was used for correlation purposes and a summary report of the testing was prepared.

   At the request of Transport Canada, a vehicle used by the Motor Vehicle Test Centre in Blainville Quebec was transported to the MSED for cross-correlation purposes. The MSED serves as the reference centre for the Transport Canada vehicle exhaust emissions test laboratory.

New Light Duty Vehicle Compliance 3200 - 67820

Project Manager: P. Barton (998-9590)

Objective

To conduct emissions testing on a selected range of light duty passenger cars and trucks (less than 6000 GVW) representing the most popular makes and models offered for sale in Canada to determine whether they comply with the applicable exhaust/evaporative emission and diesel particulate standards and meet the current fuel economy guidelines.

Selected vehicles from the surveillance fleet are test driven by the MSED on a designed urban and highway test route for mileage accumulation. The remainder of the vehicles are driven at the Transport Canada Test Centre, Blainville, Quebec.

Vehicles, which do not meet standards, or do not meet the Transport Canada specified fuel consumption guidelines, are investigated by an industry/government team and corrective action is taken by the manufacturer. The MSED participates in the investigation by providing engineering and testing personnel, testing facilities and advice.

Relevance

It is essential that new motor vehicles comply with the emission standards under the Motor Vehicle Safety Act to prevent an increase in the air pollution burden in Canada.

Work Plan

1. *Conduct 300 urban and highway exhaust emission tests on 50 new vehicles.*

   Conduct a minimum of 100 evaporative emission Sealed Housing for Evaporative Emissions Determination (SHED) tests.

   Test drive 10 to 12 vehicles to 3,500 km for a total of 42,000 km.

3. *Investigate 8-12 failed vehicles including conducting 40 exhaust emission tests and provide technical services and facilities as required. (Investigations average 3 days each).*

4. *Prepare reports for Transport Canada on each vehicle and on each failure investigation.*

5. *Conduct special vehicle test projects for the Transport Canada Energy and Emissions section resulting from evaluations of vehicle performance, failure components and consumer complaints. Two or three test projects will be conducted totaling 20 to 30 urban highway exhaust emission tests.*

Status Report - March 31, 1991

Vehicle Status:

	1989	1990	1991	1992
Received	64	45	49	1
Released	57	41	0	0
Testing	7	6	5	0
Investigation	7	6	0	0

Emission Tests:		
	Urban	240
	Highway	65
	Evaporative	56

Compliance Reports Completed Total 60

Compliance Investigations

3. a) i) A 1989 Lada Samara was noncompliant with exhaust emissions. The manufacturer has examined the vehicle and has not yet determined the cause of the high emissions. The investigation is ongoing.

ii) A 1989 Golf diesel was determined to be non compliant for particulate mass. The investigation is ongoing.

b) Testing of a GM 1989 C-15 P/U has resulted in a compliance failure. The charcoal canister was replaced and the vehicle showed improvement for a limited number of tests. The canister has since been purged and the vehicle retested. The investigation is ongoing.

c) Testing of a 1989 GM C-15 P/U has resulted in a compliance failure. The charcoal canister was replaced and the vehicle showed improvement for a limited number of tests. The canister has since been purged and the vehicle retested. The investigation is ongoing.

d) Testing of a 1990 Chrysler Plymouth Sundance has resulted in a compliance failure. The vehicle was transported to Chrysler in Detroit where it underwent testing and was returned to the MSED for further testing. The vehicle is still noncompliant. The investigation is ongoing.

e) Testing of a 1990 Ford Escort GT resulted in noncompliance for Carbon Monoxide. The vehicle was sent to Ford in Detroit where it was tested and returned to the MSED. The vehicle is still noncompliant and the investigation is ongoing.

f) Testing of a 1989 Jeep YJ resulted in urban fuel consumption numbers higher than the manufacturers rating. A new shift schedule has been supplied by the manufacturer and has resulted in an improvement in fuel consumption although still above the rated values. Investigation is ongoing.

g) Five other 1989 and four 1990 model year vehicles are being investigated for high fuel consumption. These vehicles are currently being mileage accumulated to 6000 km in Blainville.

h) Four 1991 model year GM vehicles were found to have fuel consumption higher than the manufacturers ratings and are currently being mileage accumulated to 6000 km in Blainville.

4. A total of 45 reports were prepared for Transport Canada on the compliance testing.

New Heavy Duty Vehicle Emissions 3200 - 67825

Project Manager: G. Rideout (998-9590)

Objective

To conduct a vehicle test program on new model heavy duty vehicles which represent the most widely used combination of engine and power trains in Canada. This activity is designed to determine the contribution of this mobile source to the deterioration of the air quality, establish an understanding of the offsets from engine certification to vehicles testing and determine the effects of new power plants and emission control technologies on the exhaust emissions.

The fleet to be tested would consist of light/heavy duty trucks, heavy transport tractor-trailers, urban buses, off-road vehicles and equipment.

Relevance

It is necessary to conduct a heavy duty vehicle exhaust emissions monitoring program to ensure that each new model year does not increase the pollution burden and that model years designed to meet more stringent emission standards reflect these standards in lower vehicle emissions.

Work Plan

1. *Conduct a program to develop the vehicle specific cycles required to evaluate the exhaust emissions from each type of heavy duty vehicle.*
2. *Conduct 60 heavy duty vehicle tests (vehicle specific cycles) on a fleet of 20 vehicles.*

Status Report - March 31, 1991

1. **Three groups of on-road vehicles were evaluated to determine the exhaust emissions and fuel use during the year. The vehicle groups were as follows:**
    - a) **classic coach MCI, New Flyer and Ikarus urban transit buses purchased for use by the Ottawa Transit Authority.**

(b) heavy duty construction truck with an L10 Cummins engine purchased by Transport Canada for use at the Ottawa International Airport.

(c) Thomas GM school buses powered by GM 5.7 L gasoline engines supplied by Gaz Metropolitain of Montreal.

(d) para-transpo buses with a new Navistar 7.3 L diesel engine and the second with a GM 5.7 L gasoline engine. Both vehicles were supplied by OBI of Mississauga.

Reports have been prepared on all of the test projects.

New Fuels Evaluation 3200-67830

Project Manager: G. Rideout (998-9590)

Objective

To carry out testing programs to evaluate the use of alternative fuels in both light and heavy duty vehicle applications. The program consists of research into the effects on emissions, both exhaust and evaporative (characterization), the performance of vehicles operating on alternative fuels and the effects on the engine/emission components.

The fuels of interest include diesel blends, alcohols and alcohol blends, propane, natural gas and dual-fuel operations such as diesel/propane, diesel natural gas, etc.

Conduct joint programs with industry to optimize the performance of vehicles operating on alternative fuels which have the potential for the reduction of exhaust emissions.

Relevance

It is essential that alternate fuels be thoroughly evaluated under Canadian operating conditions to ensure that there will be no adverse environmental consequences resulting from their use.

Methods and instrumentation must be developed to undertake a complete characterization of the exhaust and to measure precisely the unregulated pollutants of known health hazards identified in the characterization. The test data from these programs can ultimately affect regulatory decisions relating to fuels and pollutant emission level limits.

Work Plans

1. *Conduct a joint EC/Propane Gas Association vehicle testing project to evaluate a state-of-the-art fuel management microprocessor for propane fueled light duty trucks. A total of 25 exhaust emissions testing will be conducted .*

2. *Conduct a joint EC/industry (Canadian Gas Association) vehicle testing project to characterize the exhaust emissions from light duty vehicles converted to natural gas operation with the state-of-the-art electronic controlled fuel injection system. A total of 3-4 vehicles will be tested for a maximum of 25-30 tests.*

3. *Conduct a research project on the use of blended gaseous fuels, natural gas/propane and hydrogen in vehicles converted to operate on gaseous fuels. A total of 30-40 exhaust emission tests .*

4. *Conduct a joint EC/industry vehicle testing project to evaluate the emissions from a state-of-the-art flexible fueled vehicle.*

5. *Conduct a series of vehicle test projects to evaluate the reformulated fuels (both gasoline and diesel) as they are developed by the vehicle manufacturers/petroleum industry in the US. The number of tests is dependent upon the number of fuels developed.*

6. *Carry out a vehicle testing project to evaluate the "Mile" program methanol fueled buses. A total of 50 tests will be conducted.*

7. *Conduct a joint vehicle testing project, EC/EMR/MTO/industry to evaluate the performance and exhaust emissions from urban buses designed to operate on natural gas. These buses will be part of the Ontario NGV (urban bus) demonstration program.*

8. *Conduct a joint EC/GAZ Metropolitain/EMR/ORTECH vehicle test project to optimize the operation of a school bus designed to operate on natural gas with a state-of-the-art electronic controlled gaseous fuel injection system. The vehicle(s) will be supplied by Gaz Metropolitain which is conducting the demonstration project in Montreal. A total of 25 tests will be conducted for this project.*

Status Report - March 31, 1991

1. **A joint MSED/PGA project was conducted to evaluate the exhaust emissions under cold weather conditions from two vehicles converted to operate on LPG. This was an extension of the work conducted the previous winter.**

   A report has been prepared on the testing.

2. **A collaboration program with Consumer's Gas (Mississauga) was conducted to optimize the performance and exhaust emissions from a 4.3L S-10 truck converted for bi-fuel natural gas operation.**

A second objective of the program was to develop a guideline for the conversion industry for purposes of optimized vehicle setup.

Further testing is planned using a second natural gas fuel system in conjunction with catalysts designed to reduce the methane output.

4. a) EMR and the MSED are collaborating on a project to evaluate a 1991 Variable Fuel Lumina. This vehicle is designed to operate on methanol/gasoline blends from 100% gasoline to 100% methanol. This two year project will assess the effect of the fuel on the exhaust emissions as the vehicle "ages" (mileage accumulation). In addition the vehicle will be evaluated in ambient weather conditions for a series of different blends. To date the vehicle has been evaluated at three accumulation points on 25%, 50% and 85% methanol.

   A final report will be prepared at the conclusion of the program.

   b) A joint IPB/MSED/World of Wheels project was conducted to measure the exhaust emissions and fuel consumption on four "identical" vehicles operating on alternative fuels (ie: gasoline, propane, natural gas and methanol). The testing was conducted as part of a cross-Canada rally organized by World of Wheels (Halifax to Vancouver) to evaluate the alternative fuels.

   A report was prepared on the test results. This report was a section of an article written for the World of Wheels monthly magazine.

5. A joint IPB/Petro Canada/MSED program was conducted on a fleet of 8 vehicles supplied by Petro Canada. Three fuels were evaluated to determine the effects on the exhaust emissions from the various vehicle emission control technologies. The fuel blend of interest was 9.6% MTBE having an aromatic content of 17%, compared to 32% for the control fuels.

   A report is being prepared by IPB.

6. A collaborative agreement between IPB/EMR/Medicine Hat Transit Authority/MSED resulted in the testing of a new MCI urban transit bus configured to operate on neat methanol. A series of test cycles were conducted on the bus to evaluate the exhaust emissions under various driving conditions.

   A report was prepared at the conclusion of the work.

8. In a joint agreement with Gaz Metropolitain of Montreal, two new Flyer school buses converted for bi-fuel natural gas operation using the ORTECH, gaseous fuel injection, were tested for exhaust emissions and fuel consumption.

New Propulsion Technologies 3200-67835

Project Manager: F. Hendren (998-9590)

Objective

To conduct evaluation test projects on new propulsion and vehicle system technologies to determine the potential for exhaust emission reductions.

To conduct joint government/industry research projects to promote the development of new propulsion technologies for commercial applications which have the potential for significant reductions in the exhaust emissions.

Relevance

It is essential that new power plant technologies that are being developed for the Canadian marketplace are thoroughly evaluated to identify the compounds being emitted during their operation in Canadian climatic conditions. It is essential that the new technologies do not place an additional burden on the air quality by increasing the levels of known compounds or by introducing new compounds from mobile sources.

In addition, this activity provides support to industry in their development of lower emission vehicles for future use in Canada.

Work Plans

1. *Conduct a testing project to evaluate the exhaust emissions from a 2 stroke engine technology in passenger cars. An evaluation report will be prepared at the conclusion of the testing.*
2. *Conduct an evaluation project to compare the Navistar "smokeless" diesel technology with existing diesel trucks. An evaluation report will be prepared at the conclusion of the testing.*
3. *Conduct a series of test projects on state-of-the-art technology electric vehicles to determine the performance in ambient temperature conditions. An evaluation report will be prepared at the conclusion of the testing.*
4. *Conduct a joint EMR/University of Ottawa/MSED/industry project to evaluate a battery range extender concept for an electric vehicle.*

5. *Carry out a series of evaluation tests of the available electric vehicle propulsion systems. These include lead/acid batteries, sodium/sulfur, aluminum/air, hybrid systems, etc. An evaluation report will be prepared at the conclusion of the testing.*

Status Report - March 31, 1990

2. In collaboration with IPB and Navistar International, the MSED conducted a series of tests on the new Navistar engine designed to meet the more stringent heavy duty emission standards legislated for 1994. The vehicle was tested while operating on three fuels: diesel no 1, diesel no 2 and certification diesel.

   In addition, a second vehicle having a conventional Navistar engine was tested for comparative purposes.

   A report was prepared on the results.

3. The MSED conducted a pilot project with the support of Alupower, to develop a methodology for evaluating electric vehicles in Canadian climatic conditions.

   An Electrek (electric vehicle) manufactured by Unique Mobility (owned by Alupower) was driven on a chassis dynamometer in ambient temperature conditions to determine the energy efficiency, performance, range and emissions. The testing resulted in the preparation of a procedure for further electric vehicle evaluations.

5. a) A joint program with Conceptor Industries (Magna) resulted in the assessment of the electric motor powered G-van for performance and emissions.

      The G-van is the standard General Motors van converted by Conceptor for electric vehicle operation. The unit was powered by an electric traction motor using lead/acid batteries.

      The testing was undertaken to determine the range of the vehicle and the potential emissions resulting from the use of the single closed loop watering system.

      A report was prepared on the results of the project.

   b) In a joint effort with Alupower (Alcan) of Kingston, a program was initiated to evaluate the performance and emissions from a Dodge Caravan retrofitted to operate as an electric vehicle using lead/acid batteries. Unique Mobility of Colorado was responsible for the original design.

      The purpose of the project was to conduct a baseline evaluation prior to the second phase of the project consisting of an evaluation of the same vehicle equipped with an aluminum/air fuel cell.

The initial phase of the testing was begun but had to be suspended due to a charger malfunction. Further testing is proposed for next year.

A report is being prepared on the results of the project.

New Motor Vehicle Surveillance 3200-67840

Project Manager: P. Barton (998-9590)

Objective

To evaluate and measure the performance, exhaust emissions, evaporative emissions and fuel consumption of new motor vehicles (both light and heavy duty) under a variety of test conditions including ambient temperature, continuous realtime emissions monitoring and evaluation of various fuel specifications.

The data are used to evaluate more precisely the contribution of motor vehicles to air pollution in Canada (eg: more accurately predict the emission and deterioration factors).

The vehicles for evaluation are selected from the new motor vehicle compliance audit fleet (light duty) and vehicles available from the manufacturers (heavy duty).

Relevance

This work assists in addressing the environmental concerns of Environment Canada in setting future emission standards to prevent further increases in the total motor vehicle pollution burden.

Work Plans

1. *Conduct a cold weather testing project with emphasis on further characterizing the components in the exhaust, idling and the benefits of block heaters. A data report will be prepared by the MSED.*

2. *Conduct a testing project to evaluate evaporative emissions under ambient temperature conditions. A data report will be prepared by the MSED.*

3. *Evaluate the realtime emissions from new vehicles while undergoing ambient temperature testing. A data report will be prepared by the MSED.*

Status Report - March 31, 1991

1. A program conducted with IPB was designed to measure the exhaust emissions from a fleet of five vehicles under cold weather conditions. In addition, the effect of block heaters on the exhaust emission was evaluated at the varying temperatures and times.

2. The MSED was tasked by IPB to investigate the capability of the laboratory to undertake the proposed changes in the evaporative emissions testing protocol.

   A report will be prepared by IPB.

3. A project was initiated with Transport Canada to develop a continuous sampling capability/modal analysis for the determination of a fleet of average fuel economy value for the various driving modes.

In - Use Vehicle Surveillance 3200-67845

Project Manager: J. Rostkowski (998-9590)

Objective

To evaluate and measure the performance, exhaust and evaporative emissions,and fuel consumption of in-use motor vehicles (both light and heavy duty) under both laboratory and road conditions including exhaust emissions from highway, congested freeway and urban centres.

The data are used to evaluate more precisely the contribution of the transportation sector to air pollution in Canada.

Relevance

This work is essential for Environment Canada to ensure that the pollution burden from light duty vehicles does not exceed the levels determined by the applicable exhaust emission standards.

The data from this work is also used by Environment Canada to develop emission factors and to determine national inventories of emissions generated by the transportation sector.

Work Plans

1. *Conduct a testing project to evaluate the exhaust emissions from the tailpipe and in the interior of a light duty passenger car during highway and congested freeway driving conditions. The test project will be conducted in 2 major cities in Canada during the average temperature conditions of each season. A report will be prepared by the MSED at the conclusion of the testing.*

2. *Carry our a pilot test project to investigate the emission levels occurring in the interiors of urban city buses during road operating conditions. A test report will be prepared with recommendations for an expanded program.*

3. *Carry out a preliminary survey of exhaust emissions from heavy duty vehicles using a correlated opacity meter.*

Status Report - March 31, 1991

1. The MSED conducted a pilot study to develop the field instrumentation (sampling system) required to undertake the interior vehicle emissions sampling in congested freeway traffic. Sampling was conducted during July in both Ottawa and Toronto over a series of different runs. The interior vehicle results were compared with the concentration levels as indicated by the ambient monitoring stations in proximity to the on-road testing.

   A report has been prepared on the results.

3. A project was initiated by the MSED to conduct a correlation study between the particulate mass measurement system with the dilution tunnel and an opacity meter.

   The project was put on hold as a result of the heavy duty vehicle testing workload. Further testing is proposed.

Technical Advice and Assistance 3200-67850

Project Manager: P. Barton & F. Hendren (998-9590)

Objective

On a continuing basis, to provide engineering advice and assistance to the public, government agencies, other governments and private industry including technical advice, assessment of inventions and commercially available devices/additives, mobile source testing, training, equipment evaluation, loan of equipment, and direct technical assistance in the motor vehicle technology and testing field.

To provide testing, evaluation and technical advice on a contract basis to manufacturers of new vehicles (offshore) and private industry involved in the field of mobile source technologies.

Relevance

This service plays an important role in furthering the aims of the Department and is not available elsewhere in Canada.

Work Plans

1. *Respond to requests for technical information.*
2. *Provide technical assistance to Canadian exhaust emissions test facilities in the form of developing quality control procedures/programs, evaluating test data, conducting cross-correlation test projects and analysis of reference gases.*
3. *Provide analysis service to private industry as a master analysis laboratory etc.*
4. *Provide technical analysis and testing of fuel economy/emission reducing devices on a fee for service basis.*
5. *Provide vehicle exhaust, evaporative emission and fuel consumption testing on a fee for service basis. A total of 20 to 40 tests..*
6. *Attend court as expert witnesses for test projects conducted at the MSED (ie: misleading advertising).*

Status Report - March 31, 1991

2. a) Eight public vehicle evaluations were conducted during the year for individuals experiencing difficulties with exhaust emissions and/or fuel consumption.

   b) Tandem Engineering requested the support of the laboratory to verify the accuracy of a newly developed on-road data acquisition device.

   c) Esso Canada's exhaust emissions facility in Sarnia requested the services of the laboratory in fabricating exhaust emission tedlar bags.

3. a) Westward Industries requested the services of the MSED to develop and conduct a test program on a prototype utility vehicle to be sold in California.

   b) Davis Engineering supported the MSED in the preparation of a technical manual on the requirements for establishing an exhaust emissions test facility for compliance testing.

4. a) The following gas saving/emissions reducing devices were evaluated during the past year.

      i) Vitalizer (dissimilar metals)-tested on three separate occasions; for distributors and for Consumer and Corporate Affairs for court action.

      ii) Aderco-Fuel additive, tested for distributor on a contract basis.

      iii) Gas Saver 2000 (dissimilar metals)-tested on a contract basis for major distributor; Consumer and Corporate Affairs had requested test data from the distributor.

      iv) Softron-conducted a technical evaluation at the request of Consumer and Corporate Affairs.

      v) FIPS (water injection)-conducted a second test program to evaluate this process on a contract basis with the inventor and the Ontario Ministry of Energy.

      vi) Slick 50 and Tufoil (oil additives)-were evaluated for their technical merits at the request of Consumer and Corporate Affairs.

      vii) QMI-a fuel additive was evaluated for its technical merit at the request of Consumer and Corporate Affairs.

h) Envirosave (oil/gas additive)-was tested for its effect on exhaust emissions and fuel consumption at the request of the distributor.

i) Diesel fuel heater- tested at the request of the distributor, Sergibec Inc, on a contract basis.

j) Gasoline fuel heater/pressure regulator-tested for the inventor on behalf of the New Brunswick government on a cost sharing basis.

k) CV100 (fuel additive)-evaluated for its technical merit at the request of Environment Canada.

l) Maxi-Mizer (fuel additive)-the technical literature was reviewed at the request of Consumer and Corporate Affairs.

ii) Transport Canada requested the services of the MSED to conduct a testing project to determine the effects of the CVT transmission on vehicle performance and exhaust emissions.

The testing was conducted by testing a Subaru Justy with a CVT and a control (Justy) vehicle with a 5 speed manual transmission.

A report has been prepared on the results.

iii) EMR/CANMET requested the support of the laboratory to conduct compliance testing on a newly developed 5 cylinder high speed diesel for underground mining operation.

iv) Davis Engineering requested the laboratory to undertake preliminary certification testing of a new model Lada for purposes of marketing the vehicle in Canada.

v) Kleenoil Oil Inc requested the services of the MSED to manage and coordinate a demonstration program with the Ottawa Transit Authority to evaluate the benefits of micro-filter technology.

Support to New Vehicle Regulatory Development 3200-67860

Project Manager: G. Rideout (998-9590)

Objective

To conduct test projects to support Environment Canada's evaluation and development of emission regulations and guidelines for light and heavy duty vehicles.

Relevance

It is essential that testing be undertaken to assist in the development of regulations and guidelines to minimize air pollution from motor vehicles in Canada.

Work Plans

1. *Conduct a light duty gasoline/diesel passenger car/pickup truck test project to characterize the exhaust emissions at standard temperature from urban and highway cycles. The vehicles for this project will be selected from the 1990 compliance fleet. A report will be prepared by the MSED.*
2. *Conduct a series of modified evaporative emission tests including consecutive cooling-heating cycles for the diurnal heat build, extended hot soaks. The test cycles and procedures will be derived from the pilot projects conducted in 89/90. The testing is to be conducted on the 1990 compliance audit fleet vehicles.*
3. *Develop the sampling techniques to ensure quality data output for the evaluation of dioxins, furans, PCB's etc.*
4. *Conduct a test project to determine the level of correlation between heavy duty engine certification testing and heavy duty vehicle chassis dynamometer testing, specifically urban buses. This project is dependent upon the availability of vehicles that have testing conducted on the engines as per joint projects with the government and ORTECH.*
5. *Evaluate onboard refueling emissions.*

6. *Develop a duty cycle for chassis dynamometer testing for buses and for intra and intercity buses which would be used for certification purposes.*

Status Report - March 31, 1991

1. The MSED conducted a pilot project to measure the VOC and aldehyde/ketone compounds in the exhaust from a fleet of new model vehicles. Twenty vehicles were selected from the 1990 compliance programs for this testing.

   A report is being prepared on the test results.

3. As part of the OBI testing the laboratory conducted a series of tests at varying loads and at two difference engine output horsepowers (240 and 270) to determine the optimum point for performance and emissions.

   A report has been prepared on the results of this project.

4. Two projects are in the proposal stages for the development and assessment of particulate trap technologies for heavy duty diesel bus and truck engines. The projects will be initiated in the next year.

   a) In collaboration with OBI a project was initiated to measure the emissions from two new ORION urban transport buses equipped with new certified Cummins diesel engines. The engine certification testing was completed by South West Research Institute. The objective of the project was to determine the differences between the engine and vehicle results. A report has been prepared on the results of this project.

      Both projects are collaborative projects with industry (ie: OBI/Donaldson and ECS/AECL).

   b) The laboratory developed a methodology for evaluating medium duty dual axle diesel trucks for both exhaust emissions and performance.

      The project consisted of testing a dual axle truck by loading only one dual axle at the full road load horsepower. Verification testing was conducted on the LETE, DND, triple axle dynamometer.

      A report was prepared on the testing.

      The MSED conducted a study to investigate the effects on the concentrations of VOC and aldehyde/ketones from diesel engine exhaust when a diesel particulate trap was introduced into the system. A report is being prepared on the results.

Support to In - Use Vehicle Guideline Development 3200-67865

Project Manager: G. Rideout (998-9590)

Objective

Projects are to be conducted in support of Environment Canada work in evaluating in-use vehicle emissions for guideline development. Laboratory/field test projects are undertaken to develop instrumentation, procedures and to establish levels of correlation.

Relevance

It is essential that Environment Canada conduct a program of this form to determine the effects of the variables effecting motor vehicle emissions in actual driving conditions (eg: ambient temperature effects, maltuning, tampering, driver effects etc).

The program also facilitates the development of guidelines for use by the various levels of governments for monitoring the emission levels from in-use vehicles, in order to reduce the potential of an increase in pollution burden on the air quality.

Work Plans

1. *Conduct a vehicle test project to develop the instrumentation, techniques and correlation for evaluating tailpipe NOX and VOC during field sampling of light duty vehicles. A report will be prepared by the MSED including recommendations for procedures.*

2. *Conduct a vehicle test project to establish the techniques and levels of correlation for evaluating tailpipe exhaust emissions from heavy duty vehicles under road conditions using an opacity meter. The testing will include an evaluation of the correlation with chassis testing, including recommendation on testing procedures.*

3. *Develop a raw exhaust sampling system in order to correlate road test tailpipe exhaust emissions to dilute tailpipe chassis dynamometer exhaust emissions. A report will be prepared at the conclusion of the testing.*

Status Report - March 31, 1991

1. The MSED conducted a pilot project to determine the effects of introducing a diesel particulate trap on heavy duty in-use trucks and buses. After establishing baseline exhaust emissions an ECS non-regenerative trap was placed in the exhaust stream of a dual axle Astro tractor and on an older version Ottawa Transit Authority bus powered by a 6V-71 Detroit diesel.

   A report is being prepared on the work that was undertaken.

2. A project was initiated by the MSED to adapt a previously designed on-road field sampling system to large displacement diesel engines. The evaluation will continue into next year.

3. The MSED conducted an evaluation of the exhaust emissions, including a degree of characterization, on a small fleet of in-use vehicles including urban transit buses and medium duty truck. The objective of the project was to establish a database for on-road in-use heavy duty vehicle emissions.

4. The MSED initiated a project to determine the maximum percent of alcohol (ethanol) that can be added to commercial unleaded gasoline without having detrimental effects on the engine operation and on the exhaust emissions/performance of the vehicle. Presently "gasohol" is an accepted blend, sold commercially in both the US and Canada, containing 10% ethanol.

   The project will continue into next year.

5. In a joint collaboration with Transport Canada, the MSED initiated a project to investigate the potential improvements that could be obtained from light duty diesel engines (eg: 6.2 L GM and 7.3 L Chrysler) with the introduction of gear splitters and turbochargers.

   The project testing will continue into the next fiscal year.

Support to Off - Road Vehicle / Mobile Source Guideline Development 3200-67868

Project Manager: F.Hendren (998-9590)

Objective

Projects are to be undertaken in support of government work in evaluating exhaust emissions from these sources. The project results will determine emission factors to be applied to these sources for their *contribution to the deterioration of the air quality in Canada. The development of test procedures will result in the availability of guidelines for use by the provinces for monitoring these sources.*

Relevance

It is essential that Environment Canada undertakes studies of this nature in order to determine the contribution of the various forms of mobile sources/off-road vehicles to the pollution burden effecting Canadian air quality The work will result in the potential development of guidelines and regulations applicable to the various forms of mobile sources and to the development of technologies which will result in the reduction of emissions from these sources.

Work Plans

1. *Develop the sampling train and procedures necessary to evaluate the exhaust emissions from off-road vehicle/industrial equipment including the development of the equipment specific duty cycles. A report will be prepared including the recommended procedures for testing.*
2. *Conduct a series of pilot projects to evaluate the exhaust emissions from off-road vehicle/industrial equipment. A report will be prepared including the recommended procedures for testing.*
3. *Conduct a literature survey on the effects of marine engines/recreational outboard engines on inland lakes and waterways and on the testing procedures required to evaluate such engine. A report will be prepared including recommending the level of testing required.*
4. *Conduct a literature survey on the exhaust emissions from aircraft engines specifically in the areas of testing methodologies.*
5. *Conduct a pilot study on the exhaust emissions from aircraft using an airport in the urban environment using the following guidelines:*

    a) during refueling;

    b) during engine warmup/take off and landing;

    c) in flight emissions over a commuter trip (ie: Ottawa-Toronto).

Status Report - March 31, 1991

1. **The MSED designed and fabricated a sampling system for the purpose of conducting sampling on marine vessels and for aircraft engine analysis. The system was designed to sample for: THC, CO, NOX, CO2, SO2, VOC, SVOC, methane, PAH, n-PAH and trace metals.**

2. a) Literature studies were conducted on the exhaust emissions methodologies and studies on marine vessels, recreational outboard motor and aircraft engines. These studies were and will be used for the further development of the techniques used at the laboratory.

   b) A joint project was initiated with Fleet Technical Systems of the Coast Guard to measure the exhaust emissions from the diesel engines in the diesel-electric propulsion system of a 3000 ton Canadian Coast Guard Ship-Griffin, while operating on the St. Lawrence.

   This project was established as a pilot project in order to develop the methodologies for future testing to quantify the exhaust emissions from a variety of propulsion system configurations and to investigate the potential for improving the engine performance and reduction of exhaust emissions.

   A report is being prepared on the final testing conducted on the Griffin.

5. The MSED has conducted discussions with the Transport Canada-Airports Group to collaborate on a joint project to assess the emissions from operational jet engines from the tarmac and taxiways and jet engines. The testing will be conducted in a range of ambient temperatures.

   The project will be initiated in the next fiscal year.

Facility Upgrading 3200-67870

Project Manager: F. Hendren (998-9590)

Objective

To ensure that the facility has the capability of providing Environment Canada with the necessary data to develop regulations and guideline and to provide a facility which can support joint industry/government testing projects which will result in commercial technologies for improved air quality.

Relevance

This service will play an important role in furthering the aims of the Department not only in the area of assessing the emissions from mobile sources but also in improving the air quality as a result of technology development being transferred to industry.

Work Plans

1. *Complete modifications of the analysis laboratory dedicated to non-regulated emissions and particulate mass analysis.*
2. *Upgrade the evaporative emissions enclosure for the evaluation of onboard fueling emissions.*
3. *Upgrade cell #4 for joint industry/government research and development testing.*
4. *Implement dedicated preconditioning cell.*
5. *Install a loading ramp at the facility to have the capability of removing research and correlation vehicles from enclosed transportation vans.*
6. *Modify the grade at the entrance of cell #1.*
7. *Relocate the fuel storage shed to provide soak space for multiple buses during ambient temperature programs.*

Status Report - March 31, 1991

1. The fabrication of the organic analysis laboratory for conducting VOC, methane, SO2, hydrogen and SOF from mobile sources was completed. The MSED chemical technologists have initiated the operational setup of the laboratory.
2. Air handling systems were upgraded for the evaporative emissions enclosure and the calibration laboratory.
3. The fueling system in the explosion proof room was upgraded to reduce the background hydrocarbon levels. In addition the capability to handle an increased volume of diverse fuels was implemented.
    - a) **Cell #4 was commissioned for exhaust emissions testing in ambient temperature conditions.**
    - b) **An in house designed dilution tunnel was fabricated and will be setup and commissioned in cell #4 for cold weather alternative fuels testing in FY 91/92.**
4. Dedicated horsepower/performance dynamometer area was setup including the complete fabrication of an in-house dynamometer.

Appendix A
List of Reports and Papers

Manuscript (unedited) Reports

1. Dann, T. (1990). *"Detroit Incinerator Monitoring Program - Data Report #4"*. PMD Report #90-8.
2. Dann, T., Wang, D., Mar, J., Bumbaco, M., Chiu, C., Li, K. (1990). CIRAC Workshop *"Air Toxics Measurement Program in Canadian Urban Areas (1990)"*. PMD Report #90-16.
3. RRETC (1991). *"Update and Summary Report: Measurement Program for Toxic Contaminants in Canadian Urban Air"*. PMD Report #91-2.
4. Source Measurement Section,*"Request for Proposal - Air Emissions Testing for the Ash Vitrification Program."* August 1990. PMD 90-14.
5. Source Measurement Section, Goose Bay PCB Destruction Project, *"Report on the Compliance Testing of the O.H. Materials Mobile PCB Incinerator"*, March 1990 - PMD 90-11.
6. Source Measurement Section, *"Method for the Continuous Monitoring of Flue Gases from Stationary Sources"* March 1991. PMD 91-3.
7. Source Measurement Section, *"Method for the Continuous Monitoring of Total Hydrocarbons (Heated) from Stationary Sources"*, February 1991. PMD 91-6
8. Source Measurement Section, *"Proposed Method (DS-1) for the Determination of Asbestos Fiber Concentration in Diluted Contained Sources"*, March 1991.
9. Source Measurement Section, *"Report on the Development of a Calibration Module for use with a continuous Water Vapour Emission Monitoring System for Stationary Sources"*, January 1991.
10. Source Measurement Section, *"Data Review - Asbestos Source Sampling Study of Methods {S-1/A-1} and {MS-3/A-2}"*, January 1991.
11. Source Measurement Section, *"Summary of Review - Asbestos Source Sampling/Analysis Study of Methods {S-1/A-1} and {MS-3/A-2}"*, January 1991. PMD 91-7.
12. Source Measurement Section, *"Quality Assurance Report for the Continuous Monitoring Program - HSPP Recovery Boiler Study"*, March 1991. PMD 91-4

13. Source Measurement Section, *"Proposed Study for the comparison of {S-1/A-1} and {MS-3/A-2} Sampling/Analytical Methods"*. May 1990.

14. Source Measurement Section, *"Draft Version - Screening Method for the Estimation of of Asbestos Fiber Concentrations from Asbestos Mining and Milling Operations"*, June 1990.

15. Source Measurement Section, *"Proposal for Testing of Low-NO_x Boilers at RRETC"*, October 1990.

16. Source Measurement Section, Development of Reference Methods, *"Evaluation of a Modified Particulate Train for the Measurement of Selected Toxic Metals from Municipal Solid Waste Incinerators"*, January 1991.

17. Source Measurement Section, Source witnessing forms: *"Secondary Lead Smelters Witnessing Forms"*, October 1990.

18. Rideout, G. *"Electric Vehicle Report"*. October 1990.

19. Rideout, G. *"Emissions Testingof the NRC City Bus "*. October 1990.

20. Rideout, G. *"Propane Gas Association of Canada Report"*. November 1990.

21. Barton, P. *"Testing of the Product Vitalizer."* December 1991.

22. Rideout, G. *"Emissions Testing on a Flexible Fueled (FFV) Ford Taurus"*. December 1990.

23. Rideout, G. *"Evaluation of Emissions from Urban Buses"*. February 1991.

24. Barton, P. *"Comparison Testing of a Vehicle With and Without the Gas Saver 2000"*. February 1991.

25. Rideout, G. *"Emissions Testing from Two Diesel Fueled Urban Transit Buses"*. February 1991. MSED 91-01

26. Rideout, G. *"Effects of Ambient (Cold) Temperatures on Exhaust Emissions and Fuel Consumption of an LPG Fueled Vehicle"*. April 1991. MSED 91-02

27. Barton, P. *"Emissions and Fuel Consumption Testing of the FIPS Fluid Injection System"*. April 1991.

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Appendix B
Employees

Employees ...

director's office

GRAY, Dorothy	Secretary
HOWES, Trish	Administrative Officer
LACHANCE, Edgar	Computer Analyst
LAO, Robert	Senior Scientist
MULDOON, Pat	Stores
SERGY, Gary	Manager, WN Region Office
THORNTON, Dave	Director
TOBIN, Dorothy	Records Clerk

chemistry division

BUMBACO, Mike	Chief
CARON, Tim	Contractor, Organic Laboratory
CHIU, Chung	Head, Organic Lab
DLOUHY, Joe	Head, Inorganic Lab
GRAY, Dorothy	Secretary
HALMAN, Ron	Chemist, Mass Spectrometry Unit
HENDRICKS, Bill	Student, Inorganic Laboratory
HOULE, Nicole	Technician, Inorganic Laboratory
LANDRIAULT, Mike	Contractor, Organic Laboratory
LANOY, Monique	Technician, Organic Chemistry Unit
MATHIEU, David	Chemist, Inorganic Laboratory
McDONNELL, Brian	Supervisor, FPACAQ Program
NORDSTROM, Penny	Student, Inorganic Laboratory
POOLE, Gary	Chemist, High Hazard Laboratory
RITCHIE, Scott	Technician, Inorganic Laboratory
SOWDEN, Lois	Technician, Organic Laboratory
TARDIF, Mylaine	Chemist, Organic Chemistry Unit
THIBERT, Benoit	Technician, High Hazard Laboratory
THOMAS, Bob	Technologist, Mass Spectrometry Unit

Employees... *(continued)*

emergencies engineering division

ADAMS, Carolyn	Project Engineer, Engineering
ARGUE, Steve	Chemistry Student
BASTIEN, Yvan	Chemical Engineering Student
CHORYHANNA, Grey	Contractor, Chemical Engineer
DESCHAMBAULT, Eric	Chemical Engineering Student
DUBE, Vincent	Chemical Engineering Student
DUMOUCHEL, Andre	Technician
FANTINATO, Sharon	Secretary
FYTCHE, Linda	Chemistry Student
JACQUEMOT, Sophie	Chemical Engineering Student Contractor
KELLER, Lisa	Project Engineer
KOT, Jim	Senior Technician
MARTIN, Andre	Chemical Engineering Student
PUNT, Monique	Project Engineer
SEQUIN, Natalie	Chemical Engineering Student Contractor
VELICOGNA, Dario	Chemist
VOLCHECK, Donstantin	Visiting NSERC Fellowship
WHITTAKER, Harry	Chief

emergencies science division

BARON, Jennifer	Contractor, Hazardous Materials Manuals
BIER, Ian	Student, Oil Analysis
BOBRA, Alice	Research Scientist
BOBRA, Mark	Contractor, Oil Analysis
CALLAGHAN, Sandra	Contractor, Oil Analysis
CARON, Tim	Contractor, Analytical Section
CLARK, Jenette	Contractor, Hazardous Materials Manuals
CONROD, Dale	Contractor, Oil Analysis
FINGAS, Merv	Chief
GOLDTHORP, Mike	Contractor, Analytical Section
GRIBBON, Debi	Secretary
HOLLINS, Russell	Contractor, Oil Analysis
KETCHESON, Kerry	Contractor, Manuals Specialist
KOLAKOWSKI, Beata	Student, Oil Analysis
KYLE, Dan	Contractor, Oil Analysis
LAMBERT, Pat	Contractor, Oil Analysis
LAROCHE, Nanci	Contractor, Special Projects Chemist
LAWUYI, R.	Manual Specialist
LI, Ken	Vehicle/Portable Specialist
LIUZZO, Pat	Contractor, Oil Analysis
LUKOSE, Annie	Student, Oil Analysis
MURPHY, Natalie	Contractor, Hazardous Materials Manuals
PARÉ, Jocelyn	Head, Analytical Programs
ROY, Dave	Laboratory Technician
SIGOUIN, Lise	Contractor, Analytical Section
STOODLEY, Gord	Contractor, Oil Analysis

Employees... .... *(continued)*

pollution measurement

BARRY, Christine	**Student, Secretarial**
BRADT, Paul	**Technologist, NAPS Network Operations**
BRUNET, Paul	**Head, Ambient Measurement**
CALLAGHAN, Sandra	**Contractor, Air Toxics**
CHAISSON, Gerald	**Contractor, Ambient Measurement**
CIANCIARELLI, Dominic	**Supervisor, Source Testing**
CRUPI, Ed	**Project Engineer, Source Testing**
DOWN, Robin	**Student, Source Measurement**
D'ADDARIO, Frank	**Technologist, QA & CSM**
DANN, Tom	**Head, Air Toxics**
DOUCET, Josée	**Contractor, Air Toxics**
ETLINGER, Alka	**Contractor, Air Toxics**
FEWSTER, Janet	**Secretary**
GAULN, Louise	**Student, Measurement Technology**
GILBERT, Clem	**Technologist, NAPS Network Operations**
HUIZENGA, Jack	**Student, Air Toxics**
HODGSON, Ross	**Project Engineer, Measurement Technology**
JORDAN, Mark	**Student, Measurement Technology**
KHANDELWAL, Tauren	**Student, Air Toxics**
LEUNG, P.K.	**Head, Source Measurement**
LIMOGES, Ray	**Technologist, QA & CSM**
LISTER, Michael	**Contractor, Air Toxicss**
MAR, Jim	**Supervisor, Measurement Technology**
MEADOWS, Al	**Technologist, Source Testing**
MULLER, Irene	**Student, Air Toxics**
PLANT, Matthew	**Student, Air Toxics**
RIGDEN, Ian	**Technologist, Source Testing**
SHELTON, John	**Supervisor, NAPS Data Publications**
SLATER, Robert	**Student, Source Measurement**
SOBERING, Bill	**Student, Source Measurement**
STEENKAMER, Adrian	**Chemist, Measurement Technology**
WANG, Daniel	**Project Scientist, Air Toxics**
WHITE, Luc	**Student, Measurement Technology**
WILLIAMS, Brian	**Supervisor, QA & CSM**
WILLIAMS, Don	**Chief**
YEATMAN, Rick	**Technologist, NAPS Data Publications**

Employees... .... *(continued)*

mobile sources emissions division

BARTON, Peter	Program Engineer, Engineering Section
BREALEY, George	Calibration Technician, Engineering Section
CORKE, Doug	Test Technician, Testing/Quality Control Section
EDWARDS, Elisabeth *(retired August 1990)*	Secretary
FEARN, Jim	Project Engineer
GREER, Allan	Chemical Technologist
GROVE, Jeff	Technician
HEINO, Roberta	Lab Administrator
HENDREN, Fred	Chief
HOWES, Peter	Chemical Technologist, Toxics Emissions
JOHNSON, Blair	Computer Programmer
LEMAIRE, Hélène	Chemical Technologist
McCASKILL, Clayton	Test Technician, Testing/Quality Control Section
McASKILL, Ron *(retired June 1990)*	Head, Vehicle Section
MOODIE, Ron	Test Technician, Testing/Quality Control Section
MOSHER, Gail	Test Technician
POIRIER, Gaetan	Sr. Vehicle/Engine Technologist, Engineering
PRYCE, Kesort *(retired June 1990)*	Vehicle Processing Technician
RIDEOUT, Greg	Program Engineer, Toxics Emissions
ROSTKOWSKI, Jacek	Head, Testing/Quality Control Section
SOULIGNY, Michel	Senior Calibration Technologist, Engineering
THOMPSON, Charlie	Test Technician, Testing/Quality Control Section